The Electrical Industry's Weekly Magazine

February 16, 1959

# Electrical World

Price 50 Cents

A McGraw-Hill Publication

## Long-range planning shows...

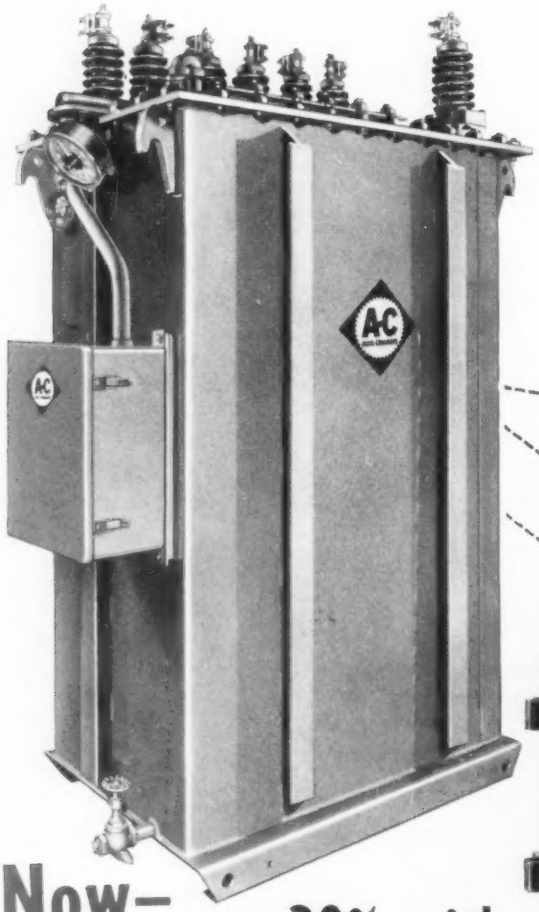
# 230-Kv Expansion Inevitable

...page 68

STEVENS RICE GS W
UNIVERSITY MICROFILMS I
313 N 1 ST
ANN ARBOR MICH

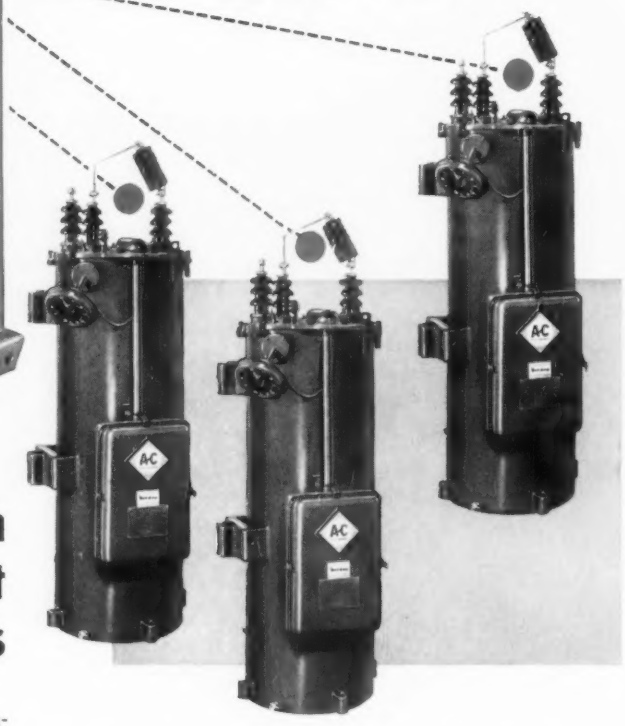
## J. H. Foote Nominated to Head AIEE...p 62

**ALLIS-CHALMERS — 25 years of leadership in 5/8% regulators**



Plan to stay ahead... MODERNIZE!

# Save 30%...



## Now— save 30% with one 3-phase unit or 3 single-phase units

The low-cost 3-phase distribution regulator is another Allis-Chalmers first in regulator development released in our 25th Anniversary year. It features these exclusive advantages:

1. **30% less cost for 3-phase regulation.**
2. **20% less weight for easier handling, faster installation.**
3. **33% less installation space.**
4. **160% *Vari-Amp* rating to 600-ampere maximum.**

Available ratings include: 500 and 750 kva, 8660 volts, and 500, 750 and 1000 kva, 13,200 volts — these regulators also available in forced-air ratings.

Mechanical features include the outstanding "Quick-Break" tap-changing mechanism, *Feather-Touch* control; unidirectional breather; and *Vari-Amp* rating.

This development completely changes the economics of 3-phase regulation. Savings are important enough to warrant re-evaluation of present substation commitments.

**Get details** from your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

*Originators of 5/8% Step Regulators*

**ALLIS-CHALMERS**

A-5857

*Feather-Touch* and *Vari-Amp* are Allis-Chalmers trademarks.

# Electrical World

Vol. 151, No. 7 FEBRUARY 16, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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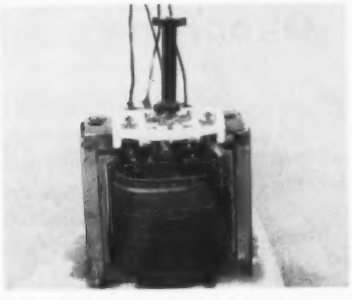

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Okonex-Okoprene 15kv primary distribution cables solve Magnolia Petroleum Company's space problem and climate problem (wet and salty atmosphere) and provide greater safety in its Beaumont refinery.

# Magnolia Refinery improves voltage regulation, beats humidity with Okonex-Okoprene cables

The giant 1,500-acre Magnolia Petroleum Company refinery, located on the broad Gulf Coast Plain, generates and uses 900,000 kilowatt hours a day, more than its neighboring city of Beaumont, Texas. A cable breakdown here could cause costly damage to equipment and the material in process (more than 400 oil products are manufactured). The entire cable system must serve Magnolia's round-the-clock operation without interruption in the face of the high moisture-saline content of the air, plus the chemicals and intense heat used at many of the processing units.

For the 15kv primary aerial loop distribution system, Magnolia's engineers selected shielded Okonex-Okoprene cables. These butyl-base insulated, neoprene-sheathed constructions saved space, eliminated safety problems and provided improved voltage regulation far superior to previous open wire constructions and other insulated cable constructions studied. In addition, their excellent moisture, heat and corrosion resistance were important assurances of maximum service life.

Okonex-Okoprene, in 3,000 to 15,000 volt constructions, was also used for trunk feeders to and from substations, tie lines and motor leads installed both aerially and underground.

To help you specify the optimum cable for your important power and control cable needs, contact your Okonite representative or write for the free Bulletin EW-1117, "How to choose insulated cable," to The Okonite Company, Passaic, New Jersey.

*where there's electrical power . . . there's* **OKONITE CABLE**

6339

## England's Central Electricity Authority

Financial statements are dfficult to interpret, but there are certain items that can be picked out such as interest, depreciation, and net income. Therefore, I feel fairly secure in giving you a few items of general interest from the financial statement of the Central Electricity Authority.

The statement that I refer to is for the nine months ended December 31, 1957 which has just been given to me.

Fixed assets, less depreciation, amounted to $1,425 million. There are other items such as inventories which are not included in this figure. Interest charges amount to $39 million or 2.7% of fixed assets. Depreciation amounts to $51 million or 3.6% of fixed assets. The consolidated deficit for the period was $7.5 million.

From this one can only conclude that the operation is in quite a shaky position. We might suggest that our good neighbors consider a rate increase this year. Then they might balance the books, pay the going rate of interest, and perhaps supply a little tax money for the treasury.

Fischer Black


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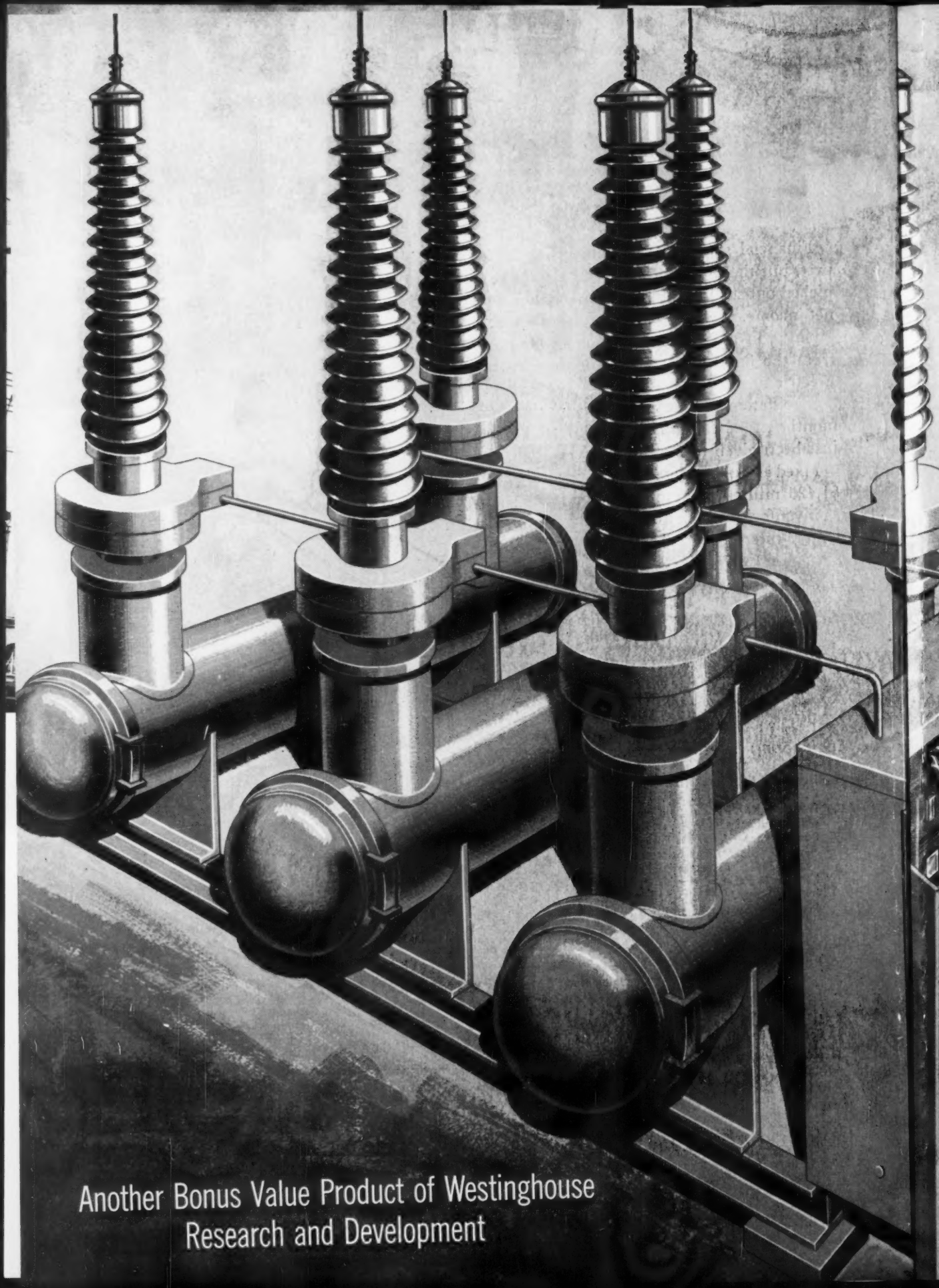
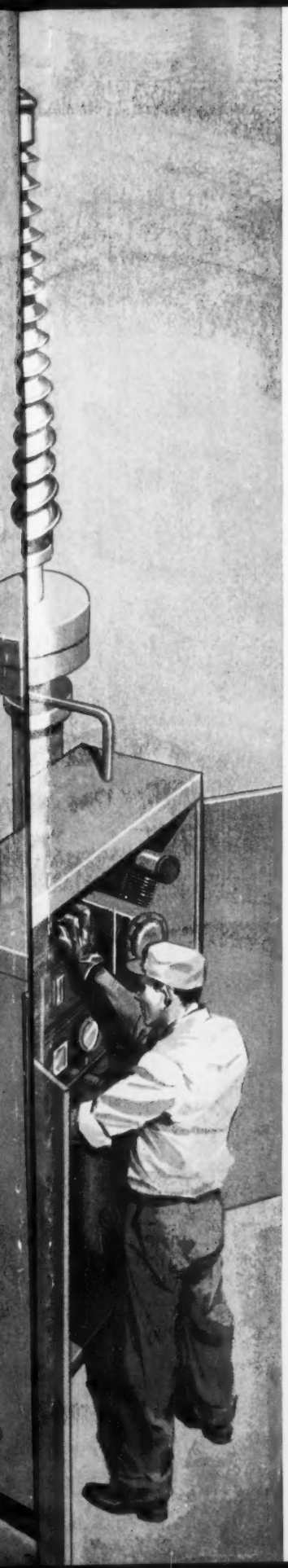


Another Bonus Value Product of Westinghouse
Research and Development



# WESTINGHOUSE ANNOUNCES

## New Power Circuit Breaker Using $SF_6$ Gas

### The Only Significant Advance in Circuit Interruption Techniques in Over 15 Years

A revolutionary 230-kv, 15 million-kva, high-capacity circuit breaker, using sulphur hexafluoride ($SF_6$) as the extinguishing medium, has been developed at the Westinghouse High Power Lab. This new interrupting technique will permit higher breaker ratings and much longer, more economical operating life than present designs.

This unique new horizontally mounted breaker brings the industry many radical design innovations with important savings in installation and maintenance.

**Drastically slashes maintenance.** This unusually stable gas does not decompose, and thus its life is not the controlling factor in time between maintenance. The interrupter assembly can be easily removed at ground level for inspection and maintenance — no scaffolding is required.

**Allows simplified foundations.** There is no energy transfer to foundation during interruption. Reduced size and elimination of oil has reduced weight of 230-kv gas breaker by 65 percent.

**Dead tank construction** provides complete safety.

**Inexpensive, overlapping protection** with bushing-type current transformers available on both sides of breaker.

**Quiet operation.** The breaker has a closed gas system, thus no discharge to atmosphere, which keeps the noise to a level comparable to the oil breaker. The closed system also conserves gas and prevents contamination.

The outstanding advances in this new breaker design are made possible because of the unusual characteristics of sulphur hexafluoride gas as an extingiushing medium:

**$SF_6$ rapidly recovers dielectric strength** because of exceptional affinity for electrons . . . assures unexcelled arc extinction.

**$SF_6$ is extremely stable** . . . thus assuring long life of the insulating and interrupting medium.

**$SF_6$ has high dielectric strength** . . . at only 10 psi, it is equivalent to oil or to compressed air at 150 psi.

**$SF_6$ is nonflammable** . . . completely safe for crowded urban substations.

**$SF_6$ is inert, nontoxic and odorless.**

This new 230-kv breaker is the first of a complete line of high-capacity $SF_6$ breakers. To learn how $SF_6$ can bring new economies to your system, call your Westinghouse sales engineer, or write Westinghouse Electric Corporation, P.O. Box 868, Pgh. 30, Pa.

J-60962

**YOU CAN BE SURE... IF IT'S Westinghouse**

WATCH "WESTINGHOUSE LUCILLE BALL DESI ARNAZ SHOWS" CBS TV MONDAYS

R. C. Boyd, R. E. Friedrich and B. P. Baker inspect the interrupter components of the new $SF_6$ breaker. A high-velocity flow of gas is directed through this formed Teflon orifice to extinguish the arc.

MOTOROLA
"Handie-Talkie"®

# 2-WAY POCKET RADIO

pocket receiver (actual size)

## All new...welds your crewmen into a closer working, *better* working "team"

Linemen . . . construction workers . . . supervisors . . . any men away from their vehicles can now *retain* 2-way radio contact at *all* times, for greater everyday efficiency and instant emergency communication.

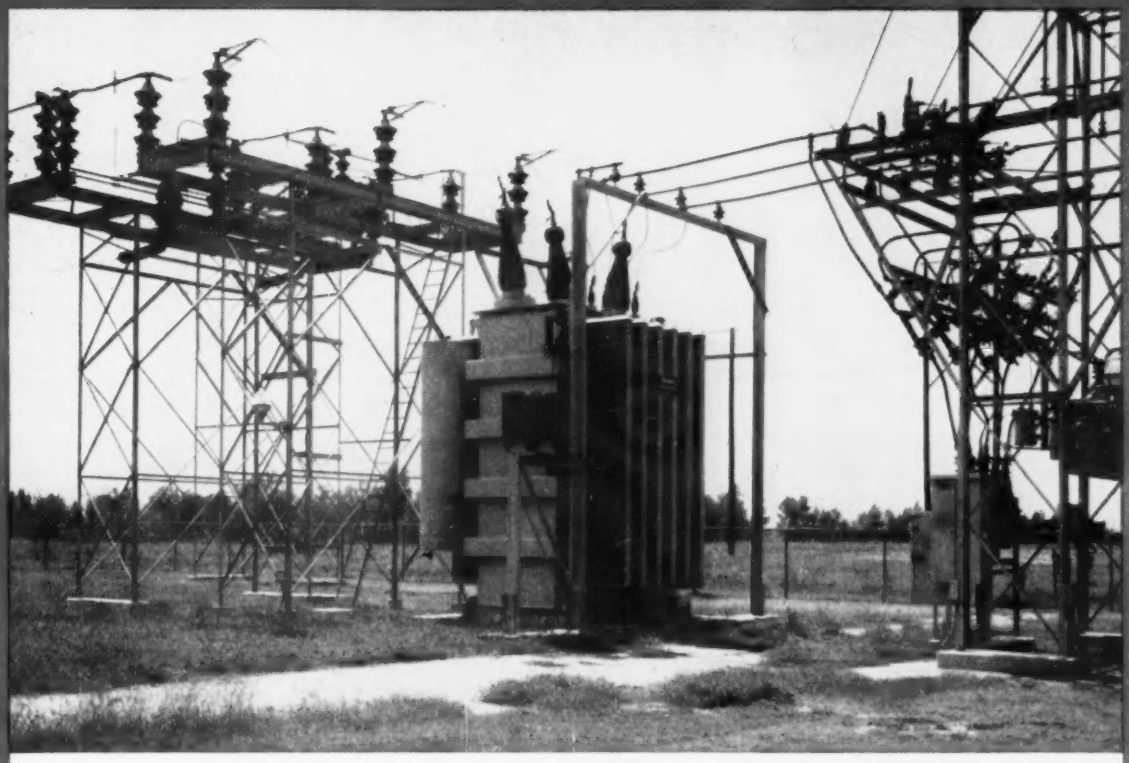
Here are individual receivers and transmitters that can be carried in the pocket or worn on the belt to give excellent local 2-way coverage.

The new "Handie-Talkie" Pocket Receiver is fully transistorized for low power drain and high reliability. With the most powerful audio output available, messages can be clearly heard even in noisy areas. Available with rechargeable battery, or standard mercury cells which give up to 200 hours of operation. Write for complete information today.

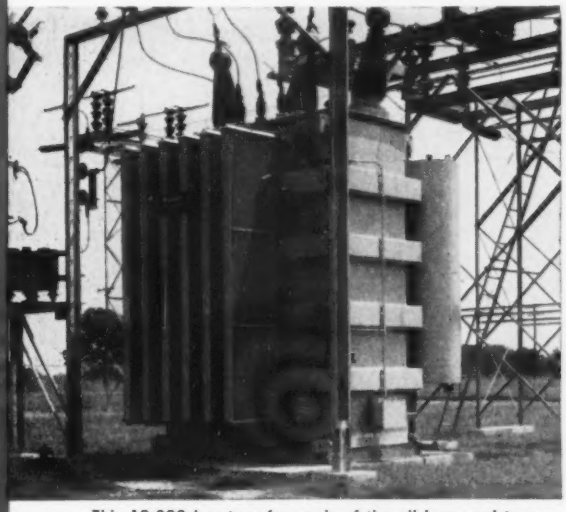
**The companion "Handie-Talkie" Pocket Transmitter has 2 to 4 times the power of similar units. With the Pocket Receiver you can have complete, lightweight, *personal* 2-way radio communications.**

**MOTOROLA** 2-WAY POCKET RADIO

Motorola Communications & Electronics, Inc., 4501 Augusta Blvd., Chicago 51, Ill. • A Subsidiary of Motorola Inc.



# ARKANSAS POWER AND LIGHT installs another WAGNER EQUIPPED SUBSTATION



This 10,000 kva transformer is of the oil-immersed type, 3 phase, 60 cycle, 55°C Rise. 115,500 v. delta to 13860Y/8000 v.

This substation, on the lines of Arkansas Power and Light Company, meets the demand for power of a new large paper mill near Pine Bluff.

To meet increasing loads and to provide always-dependable electric service, utility company planning calls for more and more transmission and distribution substations—equipped with the most dependable apparatus . . . like this 10,000 kva power transformer, one of many Wagner transformers on AP & L's lines.

Constant research and development have kept Wagner up front in transformer design for more than 65 years—made the name Wagner one of the foremost in power planning.

Wagner builds standard and special power transformers to meet practically all kva and voltage requirements. Call a nearby Wagner field engineer about your next power transformer installation. 32 branch offices are at your service.

WT59-6

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

**Wagner Electric Corporation**

6456 Plymouth Ave., St. Louis 14, Missouri.

SERVING 2 GREAT GROWTH INDUSTRIES . . . *ELECTRICAL* . . . *AUTOMOTIVE*

# FIRST essential STEP to measure increasing loads of customers who "LIVE BETTER ELECTRICALLY"

It's a fact! Over half the singlephase watthour meters now in service lack the capability to match the demands of modern electrical living.

Many of these inadequate meters are on your lines —spinning at an excessive speed in a hopeless effort to keep on measuring today's residential loads.

Carefully planned meter retirement programs are the wise answer to the problem. And the wise investments in replacement meters are Sangamo J2 Class 100 or Class 200 Meters.

These meters incorporate the most advanced features of modern meter design:

- Accurate measurement to full 100 or 200 amperes.
- Slowest disk speed.
- Highest torque in the industry.
- Corrosion-resistant construction.
- High insulation level.
- A Lifetime Guarantee.

**SANGAMO ELECTRIC COMPANY**

SPRINGFIELD, ILLINOIS

JH59-1

# PATTERN FOR POWER

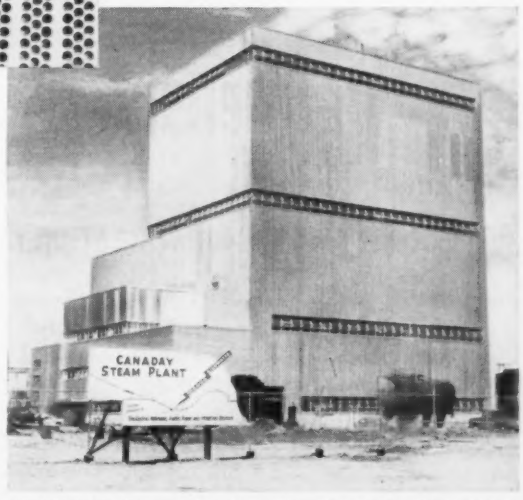
**Revere Muntz Metal Plates are combined with Revere Copper Condenser Tubes to produce reliable power for new Canaday Steam Plant, Lexington, Neb.**

This new 100,000 kw. plant owned and operated by The Central Nebraska Public Power & Irrigation District, Hastings, Neb., depends on a Foster Wheeler condenser for its source of power.

Revere Arsenical Copper Condenser Tubes and Revere Muntz Metal Plates were selected by Foster Wheeler to fit the specific operating conditions that will be encountered in this particular operation. Other operating conditions require other alloys.

It is this careful selection of the "metals to fit the job" that has built, for Revere, a reputation for dependable condenser tube and plate performance under all kinds of operating conditions.

Over the years, Revere's Research Department has compiled extensive data regarding the relative corrosion resistance of the different alloys under a wide variety of operating conditions. Why not take advantage of this storehouse of facts and consult with Revere's Technical Advisory Service before selecting the tubes and plates for your equipment?




**ABOVE YOU SEE** exterior of the Canaday Steam Plant which is equipped with a Foster Wheeler condenser. The 4 Revere Muntz Metal Plates used measure 7' 10" x 10' 3" x 1¼" while the Revere Arsenical Copper Tubes are 1" O.D. x 18BWG x 30'.

**REVERE COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*
*230 Park Avenue, New York 17, N. Y.*

*Mills: Rome, N.Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N.Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities. Distributors Everywhere.*

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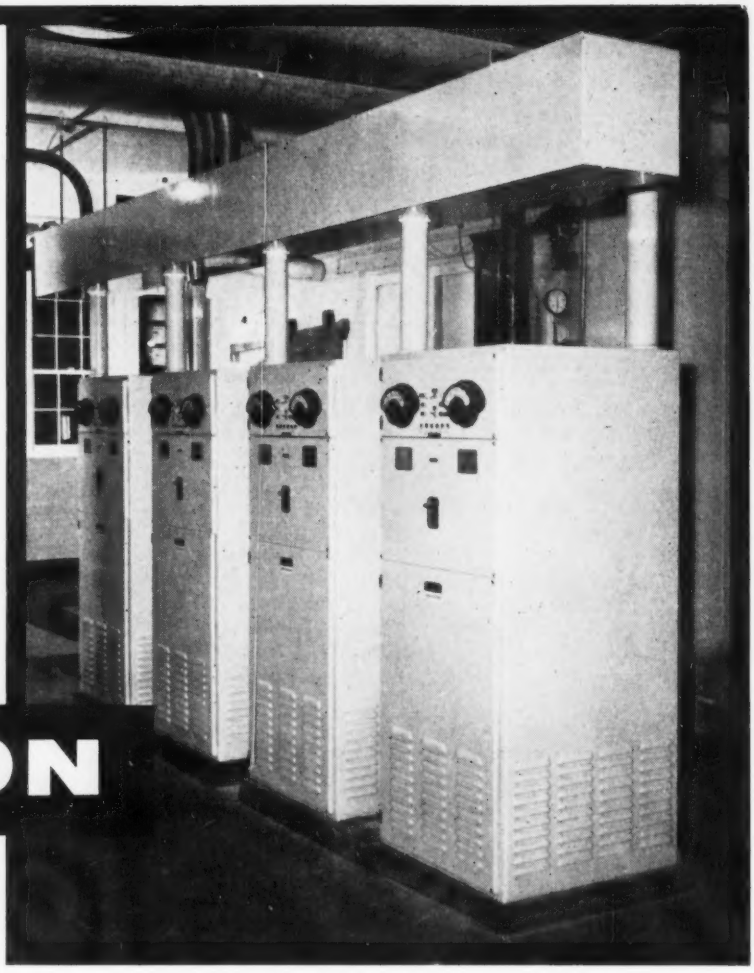
INTEGRAL FINNED TUBE • BIMETAL TUBE • INSTRUMENTATION TUBE • CONDENSER TUBES IN CUPRO-NICKEL, ALUMINUM BRASS, ADMIRALTY, HERCULOY, ARSENICAL COPPER, MUNTZ METAL AND OTHER ALLOYS. ALUMINUM TUBE, SHEET AND EXTRUSIONS. SMALL AND LARGE PLATES IN CUPRO-NICKEL, COPPER, HERCULOY, MUNTZ METAL, NAVAL BRASS AND ADMIRALTY.

another proven ECONOMY performance by RICHARDSON-ALLEN

# SILICON RECTIFIERS



## 500 KW RECTIFIER INSTALLATION CHALKS UP SAVINGS IN MONEY...SPACE...PERSONNEL

**UNITED STATES ENVELOPE COMPANY's** Kellog Division in Springfield, Massachusetts, recently completed installation of four versatile Richardson-Allen rectifiers Model S1FAB120/240520C. Designed and manufactured in four separate units capable of operating independently or in parallel, the new installation offers exceptional flexibility and compactness. Units may be used separately to provide the emergency power so often needed in other plant areas, or other plants. They may be combined two, three, four or more units at a time and new units may be added at will.

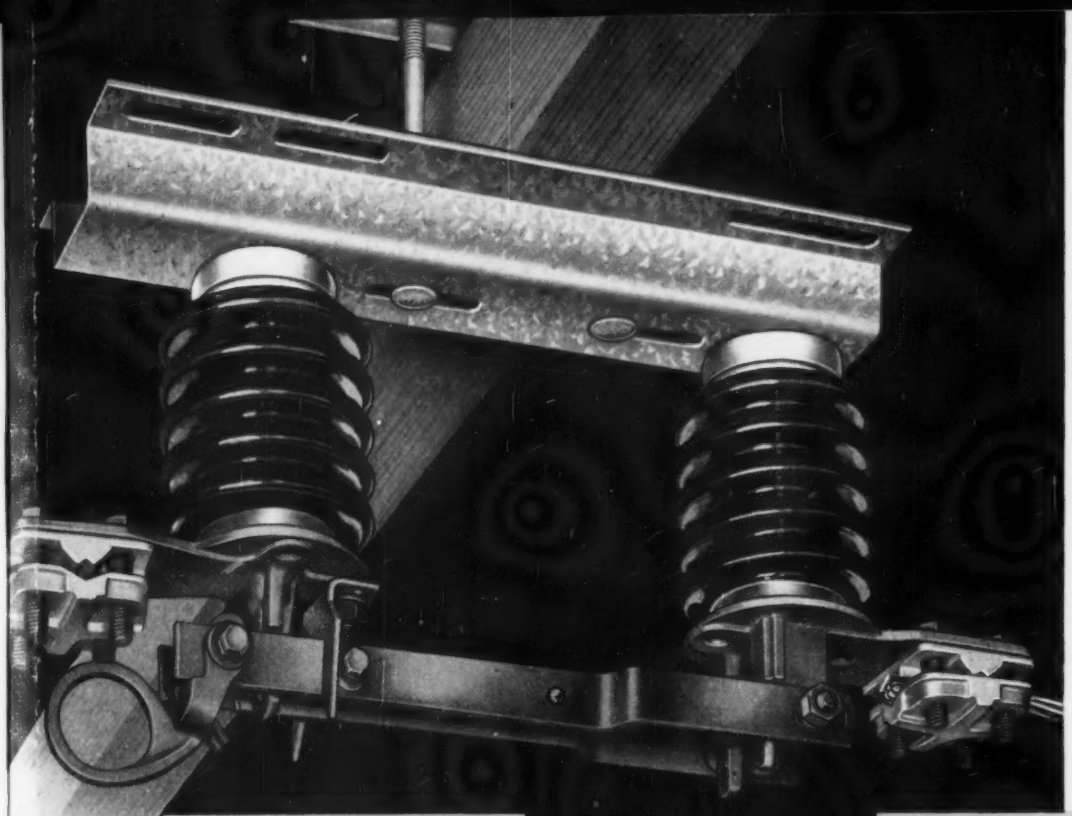
**UNITED STATES ENVELOPE COMPANY** reports savings of up to $100 per day over the cost of fuel previously used for production or power by steam-driven generator. Personnel was freed for service elsewhere in the plant and it became possible to clear much-needed space for compressor installation. Power losses at the Springfield plant were cut substantially since each of the four rectifiers Model S1FAB120/240520C delivers power of maximum efficiency.

**OPERATING COSTS GO DOWN**—Economies effected by the Richardson-Allen installation for the United States Envelope Company are typical of the savings that their Silicon rectifiers have brought to plants across the country. Richardson-Allen is now supplying major industries with highly efficient DC power—without ageing and with no apparent limit to the life of the Silicon junctions.

RICHARDSON-ALLEN Corporation

*Dependable Rectifier Specialists*

116-15 FIFTEENTH AVENUE, COLLEGE POINT, L. I., N. Y.



Type MC
400 and 600 amperes

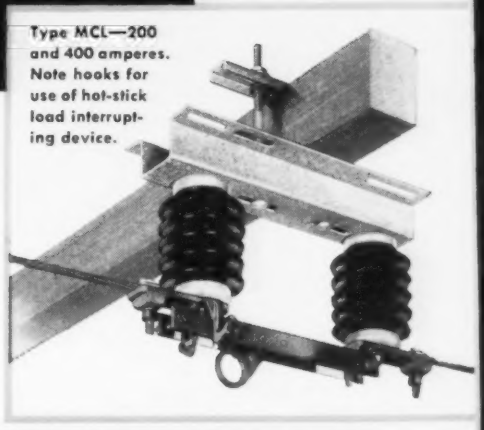
Write today for the Kearney Catalog, Section 6, on Hook Operated Disconnects

# NOW

peak performance
at lowest cost with

# KEARNEY

hook operated **DISCONNECTS**



Type MCL—200 and 400 amperes. Note hooks for use of hot-stick load interrupting device.

Sturdy, simplified construction of Kearney Center Bolt type Disconnect Switches offers field-proved performance with substantial cost savings. Current-carrying parts comply with all NEMA standards for heat rise and surge capacity. One-piece casting of terminal pads and contacts minimizes transfer points, reduces heat. Blades and blade lock are exceptionally strong and rigid. See and test this superior equipment—discover how *you* can get maximum performance at minimum cost.

- **Blade withstands 80 lbs. thrust at 90° to pull ring without distorting.**
- **90° blade stop in open position checks blade from falling free.**
- **Positive latch and pry-out prevent galling.**
- **Hinges carry no current, permit best mechanical design.**

**JAMES R. KEARNEY CORPORATION** • 4224-42 Clayton Avenue • St. Louis 10, Mo.

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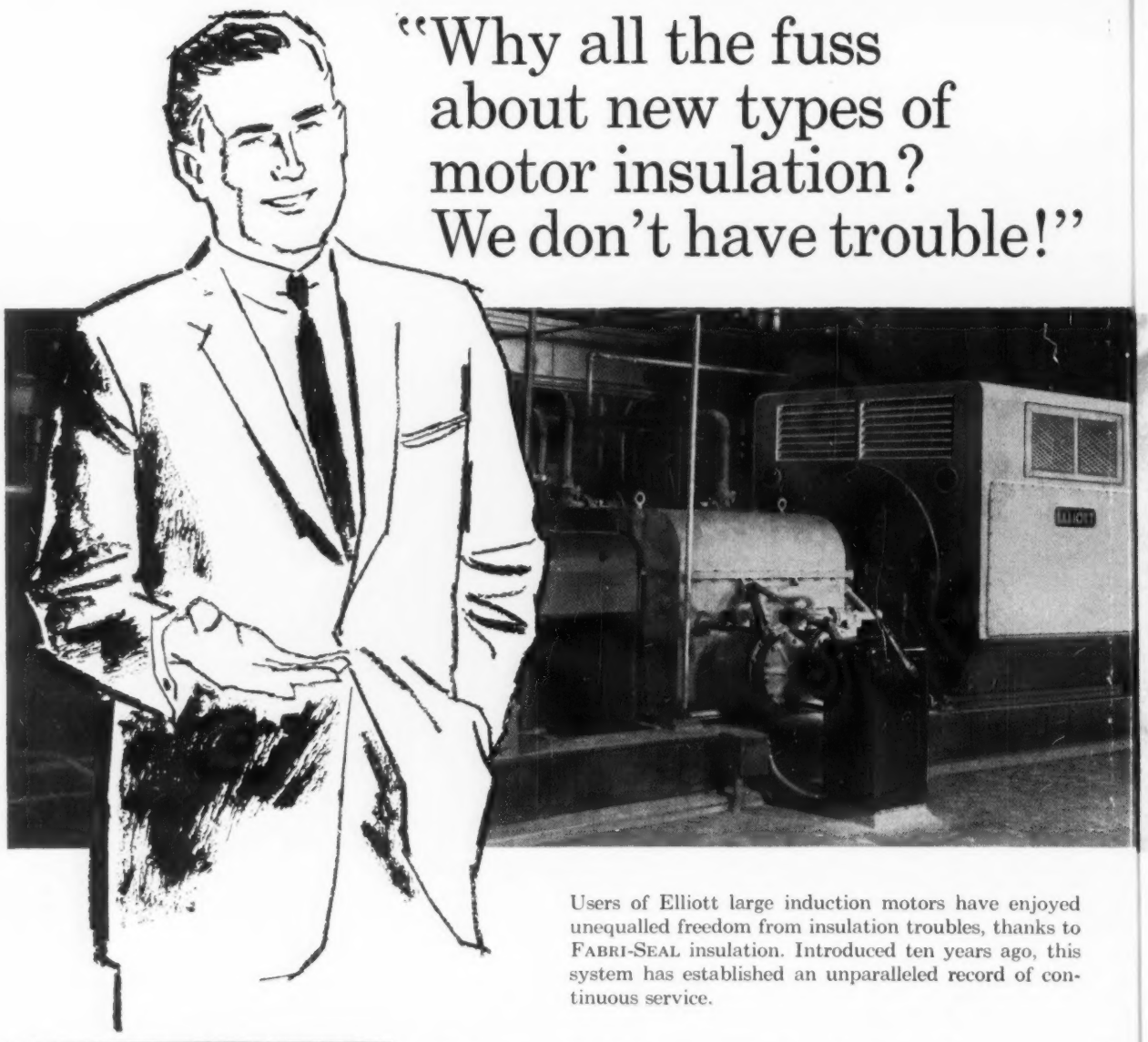
FOR BETTER CONSTRUCTION—SAFER MAINTENANCE

# Specify Kearney Products

*Plants at:* ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

# "Why all the fuss about new types of motor insulation? We don't have trouble!"



Users of Elliott large induction motors have enjoyed unequalled freedom from insulation troubles, thanks to FABRI-SEAL insulation. Introduced ten years ago, this system has established an unparalleled record of continuous service.

ELLIOTT Fabri-Seal INSULATION

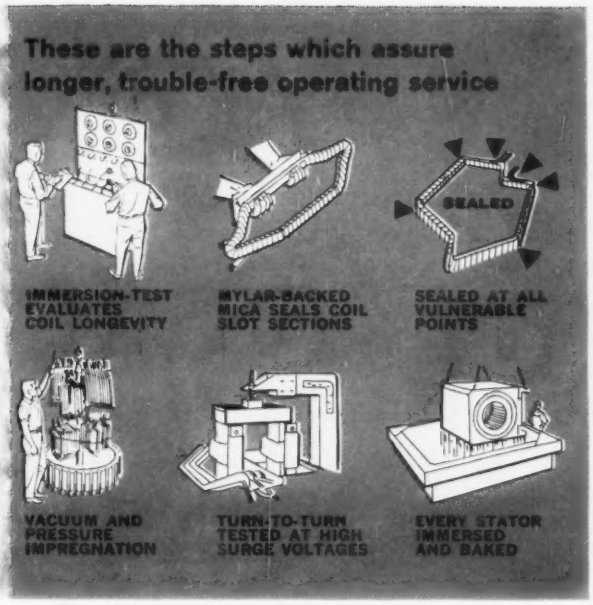
## How Elliott Fabri-Seal chalked up amazing ten-year record

FABRI-SEAL was first introduced in 1948. Since then Elliott has installed FABRI-SEAL coil insulation in over 2,000,000 hp of large squirrel-cage induction motors. The result has been unprecedented.

Today, more than 10 years after the first FABRI-SEAL insulation system was installed, operating failure has occurred at only one installation. Investigation disclosed that this breakdown was in no way due to weakness in the FABRI-SEAL system.

As illustrated here, FABRI-SEAL includes the sealing of stator coil slot sections with hand-wrapped Mylar*-backed mica wrappers, plastic-sealing at all vulnerable points, vacuum pre-conditioning and pressure impregnation to remove air and moisture, turn-to-turn testing at high surge voltages, immersion of the complete stator in special, flexible insulating varnish and subsequent baking. Rigidly-controlled fabricating procedures assure optimum protection in the finished coil.

*Dupont Trademark


These are the steps which assure longer, trouble-free operating service
IMMERSION-TEST EVALUATES COIL LONGEVITY
MYLAR-BACKED MICA SEALS COIL SLOT SECTIONS
SEALED
SEALED AT ALL VULNERABLE POINTS
VACUUM AND PRESSURE IMPREGNATION
TURN-TO-TURN TESTED AT HIGH SURGE VOLTAGES
EVERY STATOR IMMERSED AND BAKED

However, even though motors having FABRI-SEAL insulation continue to chalk up unmatched records, Elliott persistently continues its research. In the last two years, Elliott has "life-tested" hundreds of sample coils, systematically selecting and testing almost every conceivable combination of materials.

Consequently, today Elliott is installing a new and much superior FABRI-SEAL in all of its large induction motors for applications requiring Class A and Class B insulation.

The most significant step in the production of this new FABRI-SEAL is the outside sealing of the completely insulated coil and all coil connections with a special sealing layer in combination with other compatible sealing materials. Accelerated life-testing in the laboratory indicates that the advanced FABRI-SEAL will withstand immersion in water at least five times longer than the original.

## *For applications requiring class H insulation, Elliott offers Fabri-Lastic— a silicone elastomer* material with all "mechanical bugs" removed*

Elliott engineers early recognized the advantages of silicone elastomer* as a moisture barrier. Careful research, however, revealed an alarming number of inherent mechanical weaknesses. To solve these inadequacies, Elliott engineers set out to find the right combination of silicone elastomer and compatible materials which would provide the mechanical stability to withstand operating stresses normally found in applications requiring Class H insulation.

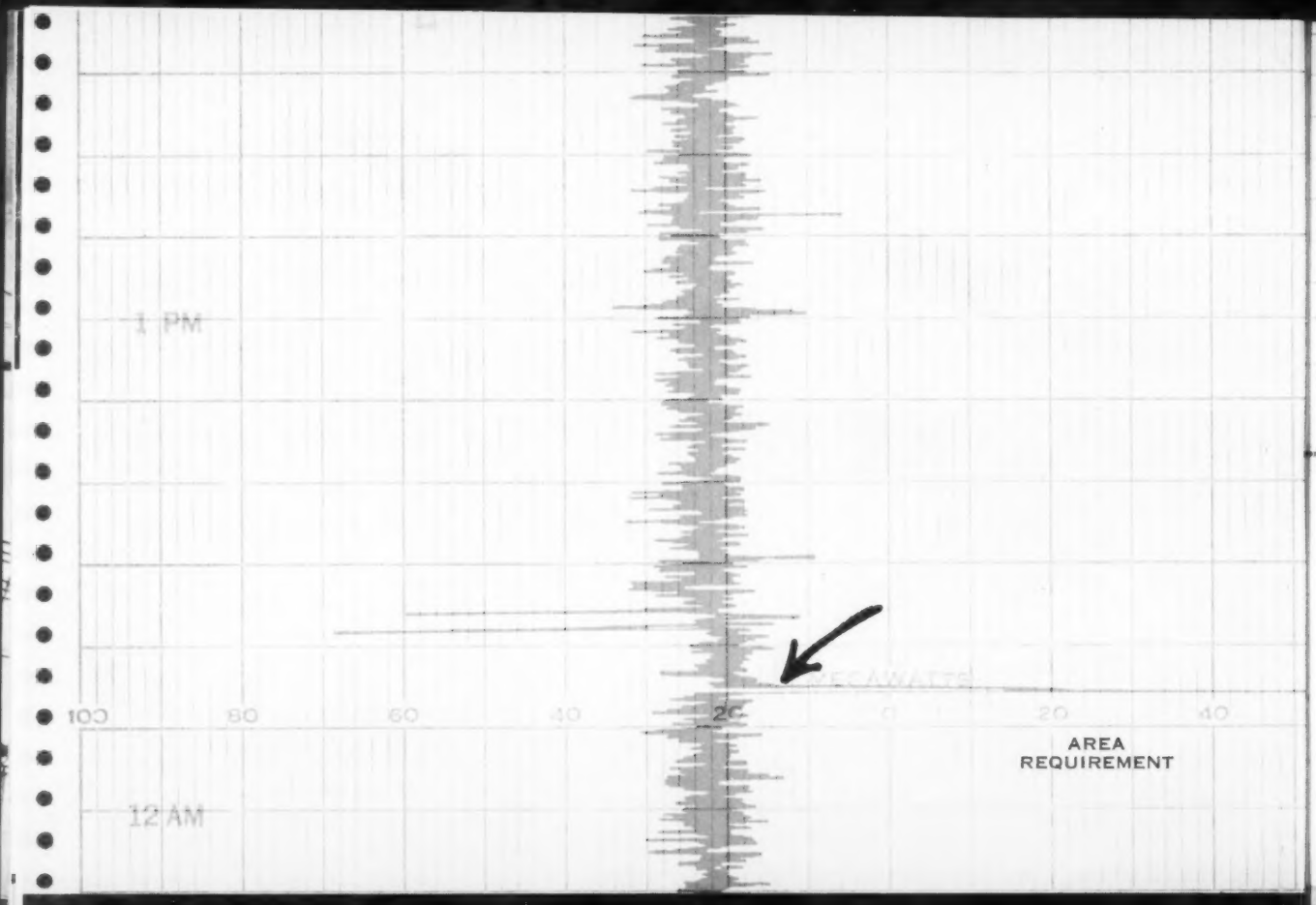
Once again Elliott research paid off. After several years of intensive experimentation and testing involving hundreds of sample coils—*the first really mechanically-adequate silicone insulation system*—FABRI-LASTIC—was completed. Basically, the new FABRI-LASTIC system consists of the skillful processing of glass-supported silicone elastomer which is vulcanized into a void-free homogeneous structure. The result: rugged mechanical and dependable sealing properties.

Benefits—in addition to flexibility and moisture protection—are outstanding durability and toughness as well as excellent thermal stability at high temperatures. Extensive lab-testing of FABRI-LASTIC indicates superior coil and lead protection from moisture, dust, dirt, oil, acids and other contaminants. In addition, protection is provided against leaks, reversion, etc., which have plagued other systems. And FABRI-LASTIC assures freedom from cracking, pull-through or shear at pressure points.

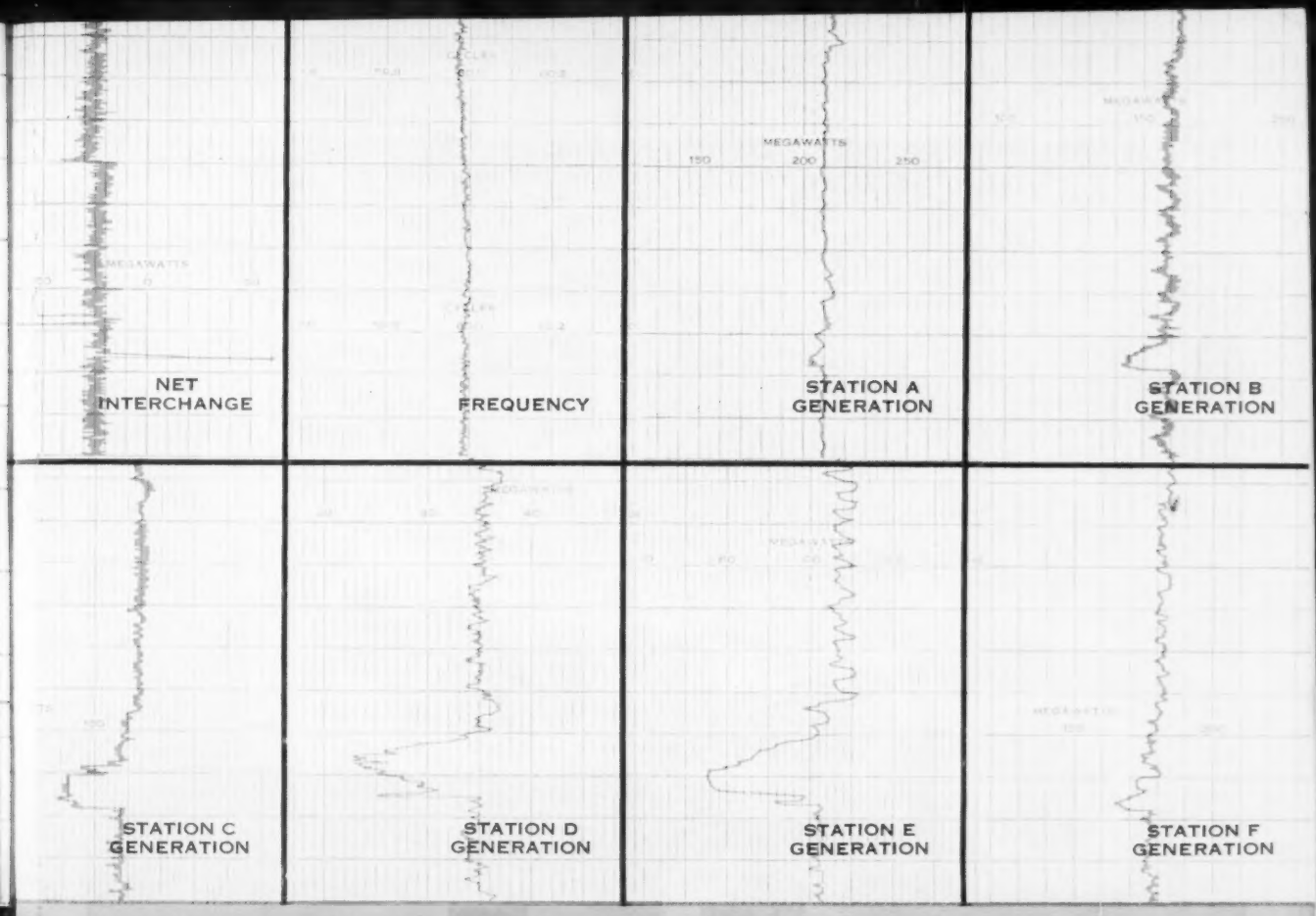
Obviously, the end result is greatly extended motor life.

**Commonly called rubber*

**ELLIOTT Company**
**RIDGWAY PLANT RIDGWAY, PENNSYLVANIA**




“In my estimation, this incident was as severe a test as we could ever experience”




"In my estimation, this incident was as severe a test as we could ever experience" . . . so said the owner of these charts who operates a large system (capacity in excess of 2,000 MW) using a custom arrangement of Leeds & Northrup economic loading controls.

The incident to which he referred involved an instantaneous loss of 110 MW load. The events which followed — as illustrated graphically above — show that when you install custom L&N controls, you get *results*.

HERE'S HOW IT HAPPENED AS INDICATED BY THE OFFICIAL DISTURBANCE REPORT:

12:14 PM With 13 steam, and two hydro units under economic loading control, an automatic breaker operation tripped 110 MW load. Tie control immediately jumped from 25 MW "In" to 73 MW "Out." All units under control dropped generation automatically. Two additional hydro units not under control were dropped 50 MW by alert Dispatchers who correctly inferred the cause of the disturbance from recorded data in the System Control Center.

12:15 PM Tie control on schedule.

12:21 PM Permission was requested to cut in 55 MW of the "lost" load. Permission granted.

12:22 PM System hit with 55 MW instantaneous load increase.

12:22:30 PM Tie control on schedule.

12:24 PM Permission granted to cut in remaining 45 MW load.

12:24:30 PM Tie control on schedule.

A most critical moment occurred at 12:15 P.M. (arrow on Area Reqt. chart) when the control brought generation into the control point at the maximum regulating rate. Under the circumstances which led to the disturbance, any hesitation by the control would have contributed to a potentially damaging system breakup. But, as one observer commented, "This control slammed into the control point at top speed and corrected the system error as if the laws of inertia had been repealed." There was no overshoot, no hunting, at any time.

When you specify L&N controls, you assure *results* because you can "custom arrange" the control components that gear your dispatching operations to the *realities* of your system's operating needs. For a complete report on the above incident, dial the number of your nearby L&N Field Office, or contact 4938 Stenton Avenue, Philadelphia 44, Pa.

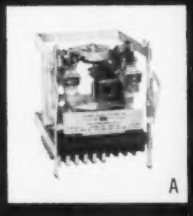
CUSTOM CUSTOM

*you get custom results with L&N custom generation controls*

**LEEDS & NORTHRUP CO.**

*Another Engineering Achievement*

# Reliable Protective Relays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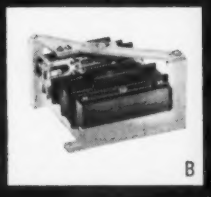
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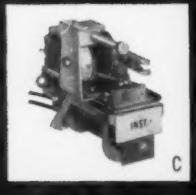

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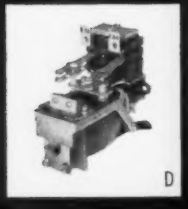

D

E

## ...the heart of quality switchgear

This proud new line of protective relays makes Federal Pacific one of only three companies able to furnish all major switchgear components, thus providing for complete quality control and undivided responsibility.

Featuring utmost reliability as well as unusual sensitivity, stability, accuracy, and simplicity, there are only three basic movements—induction disk, induction cup, and hinged armature. Any desired a-c relay characteristic can be provided through variations of the induction disk and induction cup units. What's more, these relays are designed for minimum maintenance and testing time.

A—BASIC INDUCTION DISK UNIT. Used with relays requiring adjustable time characteristics. Note separate connector on bottom which permits removal of the mechanism from the case by merely sliding it forward. No parts need be removed or wires disconnected.

B—BASIC INDUCTION CUP UNIT. This basic unit is used for instantaneous relaying applications where operating times of a cycle or less are required.

C—BASIC HINGED ARMATURE UNIT. Extremely flexible unit for use with a-c or d-c, current or voltage—with hand, self, or electrical reset contacts, circuit opening or closing, or combinations.

D—OPERATION INDICATORS. All induction relays have a combined electrical operation indicator and seal-in contactor of hinged armature design.

E—TEST PLUG. Permits complete secondary tests and checking of all connected circuits. Insertion of the plug instantly transfers relay to test circuit, removal automatically restores relay to service. Alteration of links or connections on the panel is avoided—testing is reduced to a fraction of the time normally required.

Rugged... simple... precise... and reliable. Yes, these new protective relays are worthy of your trust—as is all Federal Pacific electrical distribution and control equipment. Get the best! Write for Relay Bulletin 5-020, Federal Pacific Electric Company, General Offices: Dept. 290, Newark 1, New Jersey.

FPE

**FEDERAL PACIFIC ELECTRIC COMPANY**

The Best in Electrical Distribution and Control Equipment.

# The Electrical Week

**LATE NEWS ▶** **Sen Lyndon Johnson tells co-ops to "fight with beer bottles"**, if necessary to keep their rights under law. The Senate majority leader, substituting for snow-bound Hubert Humphrey, told National Rural Electric Cooperative Assn that Congress will not allow the Administration to send them "down the Wall Street chute." Congress will not raise 2% interest rate and it will pass the Humphrey-Price bill restoring administrator's authority to pass on loans, he said.

**N. Y. State Power Authority shuns Tuscarora Indian lands,** decides to build a smaller reservoir elsewhere for Niagara project despite higher cost per kw, says NYSPA Chairman Moses.

**Georgia Senate rams through bill which will allow co-ops** to serve within city and town boundaries. It is now before the House.

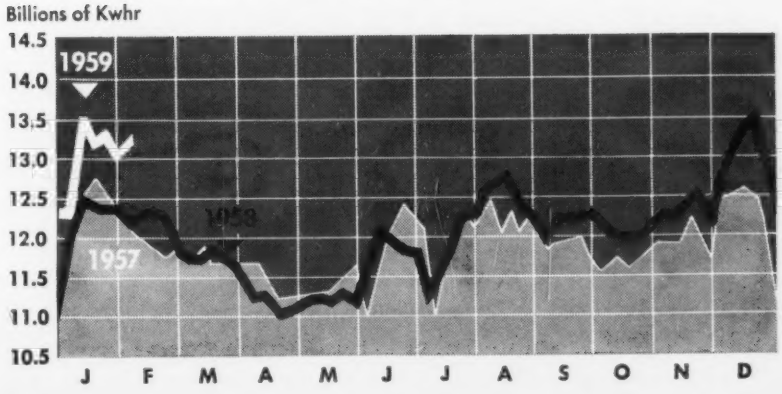
**Underwriting groups are quietly being formed** to sell TVA taxable revenue bonds if self-financing bill now before Congress becomes law.

**EEI organizes advisory Task Force on Extra High Voltage** Transmission to work with manufacturers undertaking research on lines or equipment operating above 300 kv. Members are Chairman L. R. Gaty, Philadelphia Elec; W. R. Johnson, Pacific G&E; L. F. Lischer, Commonwealth Ed; E. R. Moore, Detroit Ed; W. S. Price, American EP; L. M. Robertson, PS of Colo.; E. A. Rothfus, Ohio Ed; J. A. Vivian, Southern Cal Ed.

**St. Louis bears brunt of storms buffeting Midwest** as tornado interrupts service to 50,000 Union Electric customers. Smooth-working emergency plan brought restoration within 24 hr. No major plants or transmission facilities were affected, UE said.

**California Gov E. G. Brown wants a "long-range" program** developed by his state, Oregon and Washington on inter-regional power tie from federal Columbia River system to California.

## *WEEKLY POWER OUTPUT*—UP 8.2% (Week ending Feb. 7), Kwhr 13,292,000,000




Per Cent Change From Previous Year

| | Jan. 24 | Jan. 31 | Feb. 7 |
|---|---|---|---|
| Total U. S. | + 8.0 | + 7.5 | + 8.2 |
| New Eng. | + 8.2 | + 8.8 | + 8.4 |
| Mid. Atlantic | + 6.5 | + 7.7 | + 6.4 |
| Cent. Ind. | +10.8 | +10.2 | +10.5 |
| West Cent. | +12.5 | +12.2 | +12.0 |
| Southeast | + 4.6 | + 0.9 | + 2.1 |
| South Cent. | +10.7 | +12.1 | +12.3 |
| Rocky Mount. | + 8.2 | + 4.8 | +14.2 |
| Pacific | | | |
| NW | + 7.4 | + 8.1 | +10.8 |
| SW | + 6.3 | + 9.4 | +10.6 |

Seasonally Adjusted Index 250.0

Week Ago 244.7 Year Ago 230.7

Source: Edison Electric Institute

# Preview of this Issue

**EVENTS** ▶ **A clearer definition of the engineer's role was urged at AIEE's** general meeting by Dr J. R. Killian. He recommends accurate portrayal of the engineer's function, engineering audacity and imagination, and fostering awareness that engineering is a creative activity. AIEE Pres Hickernell stressed need for more research, called duplication of efforts wasteful. J. H. Foote was nominated as president for the 1959-60 term **(p 62)** . . . Cleveland firm plans to start production on electric car June 1. Meanwhile, its electric truck production picks up **(p 65)** . . . High-priced problem of radioactive waste disposal came under Congressional scrutiny recently. Chief conclusions: Federal regulation is here to stay, the problem is being ignored in figuring reactor economics, and present set-up inhibits nuclear plant construction **(p 66).**

**ENGINEERING** ▶ **Duke Power's system development** involves raising transmission voltage **(p 68)** . . . Modern transformer's perform consistently better than guides indicate **(p 70)** . . . Proper grounding in substations reduces shock danger **(p 78)** . . . Consumers Power tests emergency warning system, actuated by power line carrier **(p 84).**

**METHODS** ▶ **Single power line carrier links plants** with four voice circuits for

# Politics and Public Power

## NEW WRINKLES ON THE CO-OP FRONT

The big private-vs-federal power issues—2% money, private financing, "partnership" and preferences, river basin development, etc.—all got another thorough airing before the 7,000 members who attended the 17th annual meeting of the National Rural Electric Cooperative Assn in Washington last week. While the position of its spokesmen remains unchanged on traditional issues, there are some new wrinkles that will command attention of everyone concerned with the power industry. Here are the highlights:

• Watch for a stiffening of the Administration's attitude toward co-op borrowing. This was signalled by REA Administrator David Hamil, when he told co-op members, "I think the day will come when the public will ask you to pay the going rate for money, at an interest rate more in line with the cost of money to the government. Without getting into a debate over whether you are partially subsidized or not, I think you will agree that you are presently borrowing money at a bargain-basement rate of interest . . . I think it would be unwise for you to assume that the Rural Electrification Act includes a lifetime of federal financing . . . It is in the American tradition that the day will come when you will be asked to obtain at least a portion of your financing from a source other than the federal Treasury. It would be wise to start thinking and planning now, so that you won't get caught flatfooted."

• Congress is not going to allow the "partnership" approach to water resource development to endanger preference clauses in the sale of power from federal projects, Senate Minority Whip Thomas Kuchel (R-Calif.) told the

Pacific G&E . . . Wisconsin Electric Power attaches a special generator to line trucks to operate hand tools (p 72).

**MANAGEMENT** ▶ **What's ahead for electric utilities?** Fifteen charts summarize the industry's performance in 1958 and show what's in store for 1959 and beyond. Highlights: Total kwhr sales up 9% to 622-billion kwhr this year; '59 revenues pushing $9 billion; capacity to increase 26% in the next three years (p 97).

**SELLING** ▶ **Reddy Kilowatt observes his 25th anniversary this year** as symbol of electricity for investor-owned utilities. Philadelphia Electric is honored as first company to use it (p 107).

**MANUFACTURERS** ▶ **A high-voltage silicon rectifier system is made by Allis-Chalmers** . . . National-Standard Co's copper-plated guy unaffected by year's use . . . Flat-type transformer tubes are adopted by GE . . . Louisiana P&L uses porcelain enamel on boilers (p 86).

**NEW EQUIPMENT** ▶ **Cable puller for distribution work** pulls tensions up to 1,700 lb at 3 mph, or 3,100 lb in low gear . . . Compactor has four pads, each of which deliver up to 4,200 three-ton blows per min . . .(p 112).

NRECA gathering. Kuchel concentrated his fire on the Trinity River controversy of California's Central Valley project, in which power from the falling waters of the Trinity would be sold to Pacific Gas & Electric, then re-sold to customers at the company's prevailing rates. He said, "Where facilities have been created through the investment of public monies, as in the Central Valley project, and its Trinity division, I believe the power produced should be distributed to public agencies, as has been done so successfully for many years . . . I give you my assurance that Trinity will be completed as a multi-purpose federal project, and that this latest assault on the preference clause of federal reclamation law will go down to its well-earned defeat."

• Two significant developments seemed to emerge from the usually vituperative remarks of NRECA General Manager Clyde T. Ellis. First, Ellis called for the pooling of co-op advertising and public relations efforts —through NRECA—on a national basis. The firm most likely to handle the co-ops' account will be Chicago-based Aubrey, Finley, Marley & Hodgson.

The second Ellis proposal, and one likely to raise the ire of co-op and government officials as well as their critics, calls for the formation of a national trust fund, into which NRECA members would pour their mounting system reserves to "stop waste, provide liquidity and other benefits." Several well-informed persons close to the power issues see a measure of vulnerability for the co-ops in this one. "How," they ask, "are the co-ops to justify using cheap federal money for expansion and, at the same time, invest surpluses in higher-interest-bearing blue chip and government securities, as Ellis proposes?" The question is a valid one, and to date, it remains unanswered.

**Advertising campaigns to promote oil heat** will be aimed at local marketing areas in 19 eastern states by the newly formed National Fueloil Council of the American Petroleum Institute. NFC is designed to do for oil heat what AGA does for gas. **Petroleum Week, January 2, 1959.**

## TECHNICAL NOTES

**Building volume of 31 cu ft per kw** and foundation simplification were achieved by arranging unloading bays with the middle generating unit between railway tracks in a 300-Mw steam station.

**Tritium and krypton 85 provide low-level light sources** which need no outside power. Light is obtained from phosphors activated by beta particles emitted as the radioactive gas decays.

**Effective chemical control of conifers** is based on use of sodium trichloroacetate in water during the active growing season and 2,4-D and 2,4,5-T in oil at other times.

**Corrosion of buried steel can be accelerated greatly** by action of sulphate-reducing bacteria, particularly in the absence of oxygen. These bacteria are found chiefly in waterlogged clay soil.

**Non-uniform stress distribution** reduces the efficiency of a conventional string of insulators installed on a EHV line, particularly in contaminated atmospheres.

## FROM EDITORS IN THE FIELD

**Branch storerooms are replenished periodically** rather than on-demand by Duke Power Co. This practice reduces costs of transportation, handling, and administration.

**Dry-type transformers will minimize length of leads** in providing station service power at the new generating station of Potomac Electric Power Co at Dickerson, Md. Two similar transformers for main units 1 and 2 each will be rated 7,500/10,000 kva, 13.5-4.32 kv, AA/FA.

# Convenience pays off

This Thorex Dynagap lightning arrester for 345-kv service arrived on the job in *one piece*. It was lifted directly from the packing case to its pedestal. Two or three minutes - - for only a couple of men - - and it was installed!

Compare this to what used to be the installed cost of high voltage arresters. Labor, special structures, added station area, often equaled the original purchase price.

And, for this sound bargain in lightning arresters, you get an entirely new order of surge durability and equipment protection, plus complete immunity from the effects of surface contamination. Thorex Type MPR arresters of any voltage can be hot-washed by hose or spray systems.

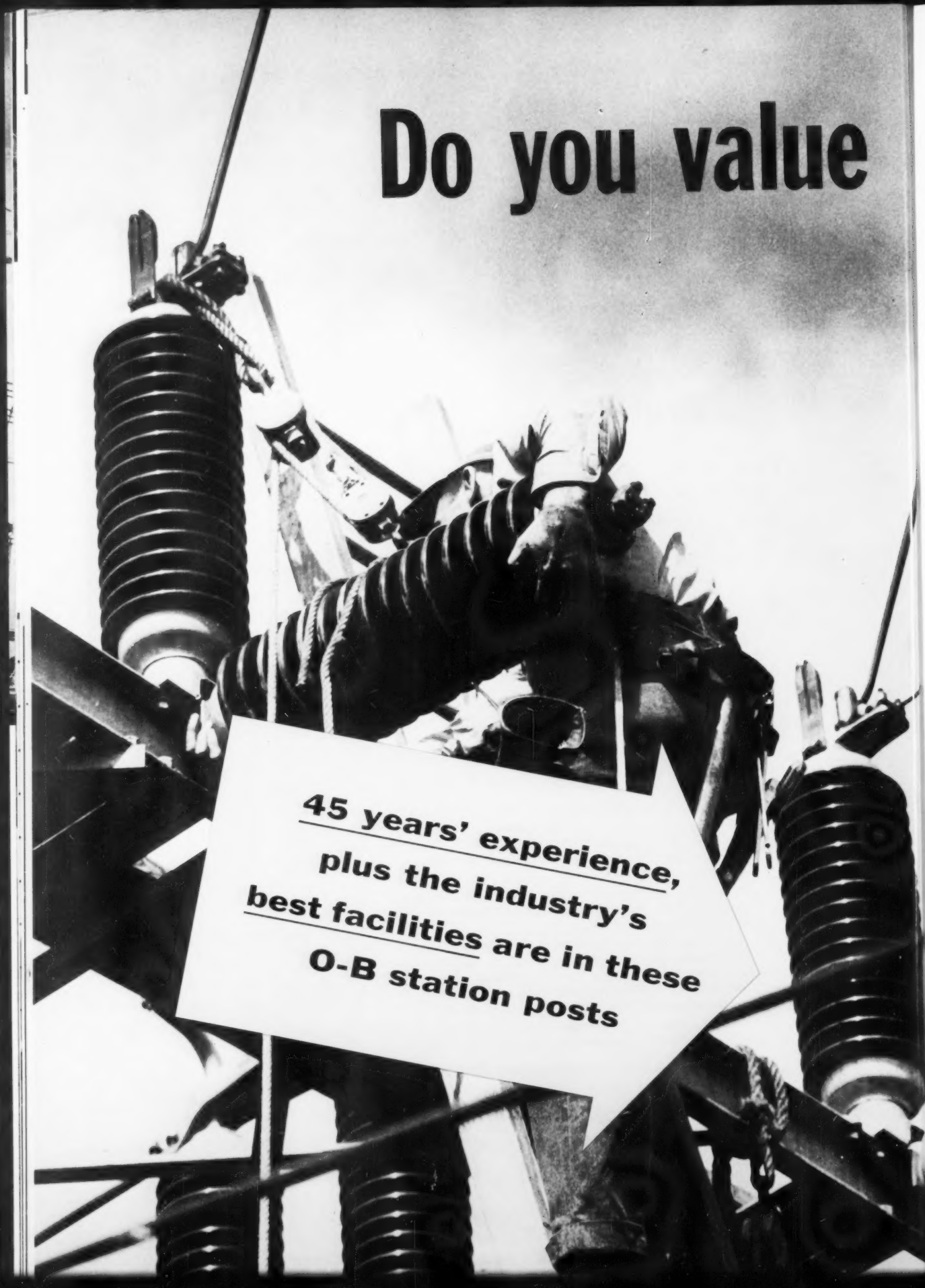
For the best of performance and - - by far - - the best installed price, put Thorex arresters in your new stations.

OHIO BRASS COMPANY, MANSFIELD, OHIO

**Ohio Brass** HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

4922-H1


Do you value
45 years' experience,
plus the industry's
best facilities are in these
O-B station posts

# post experience?

## The O-B station post is easy to get on any manufactured product- just ask for it!

Page 370 in our 1914 catalog (45 years ago) offered an O-B Station Post insulator. If you value long experience in the post business, here it is!

O-B Station Posts have since kept abreast or ahead of industry requirements. Today, the highly perfected design has features that are advantageous in many types of station construction: (A) Inherently high strength. (B) Great rigidity to assure proper gathering action of switches. (C) Long surface leakage length that is helpful in certain cases of air-borne contamination. (D) High resistance to lightning damage.

Switchgear and "packaged" substation manufacturers will gladly supply your choice of post insulators if you merely *express that choice.* Take advantage of the longest experience and best technical facilities in this branch of the industry. Ask your supplier for the O-B post. Name it, and you can have it!

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass (B) HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
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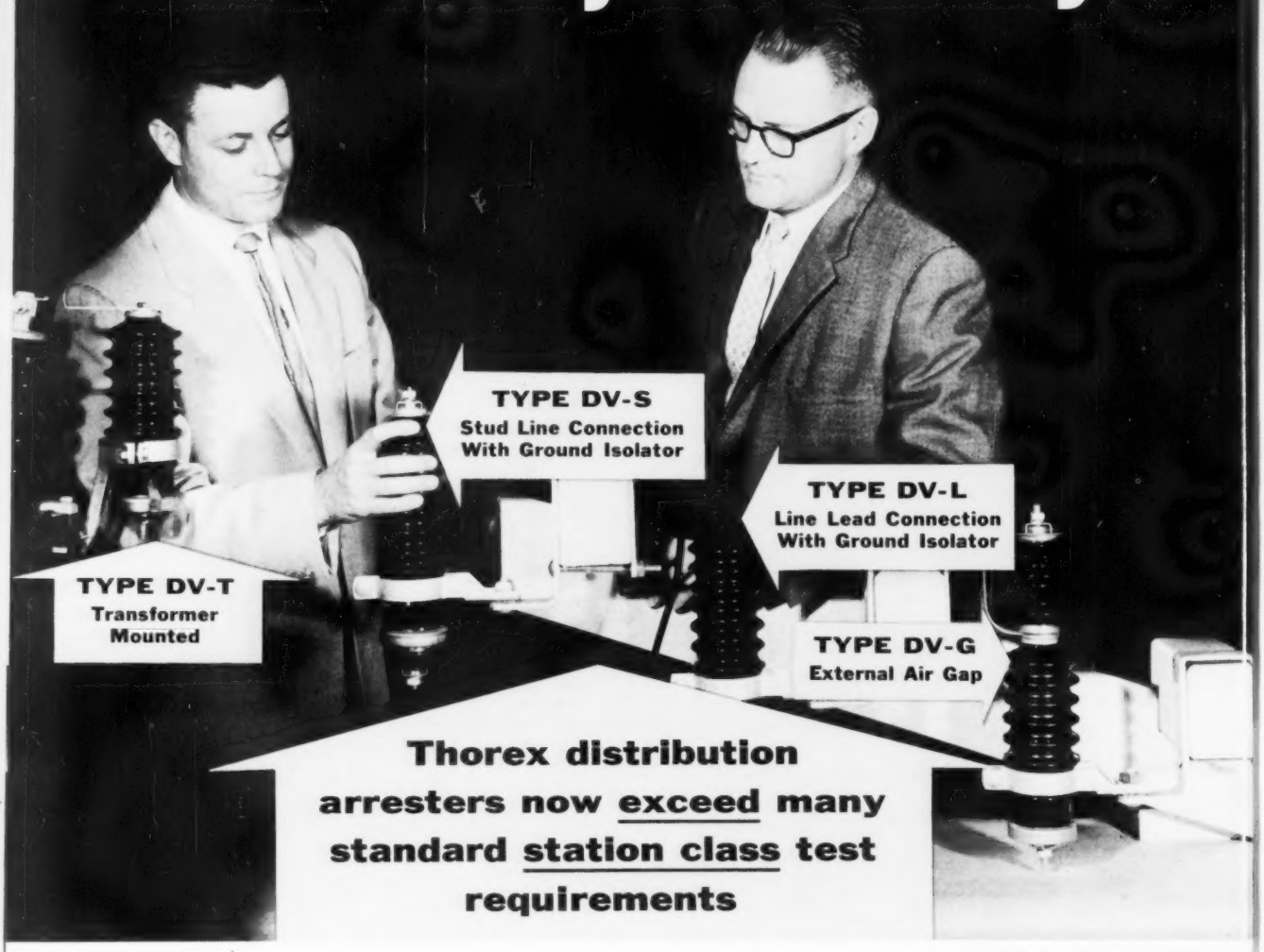
# More than just variety....




## Thorex distribution arresters now exceed many standard station class test requirements

Thorex distribution arresters go far beyond just meeting your preference with their variety of designs. These remarkably efficient protective devices exceed, by a wide margin, many present Standard test requirements of the heaviest duty Station Class. And all of this in a poletop arrester 10 to 50 per cent smaller than comparable models.

Possibly this best evaluates the remarkable advancement in the arrester art represented by the Dynagap. This same protective element is interchangeable in all Thorex ratings and classes - - hence the unheard-of performance of distribution grades.

For a degree of service and equipment protection totally new in distribution practice, at no cost premium, put Thorex Dynagap Type DV arresters on your system.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

HOLAN

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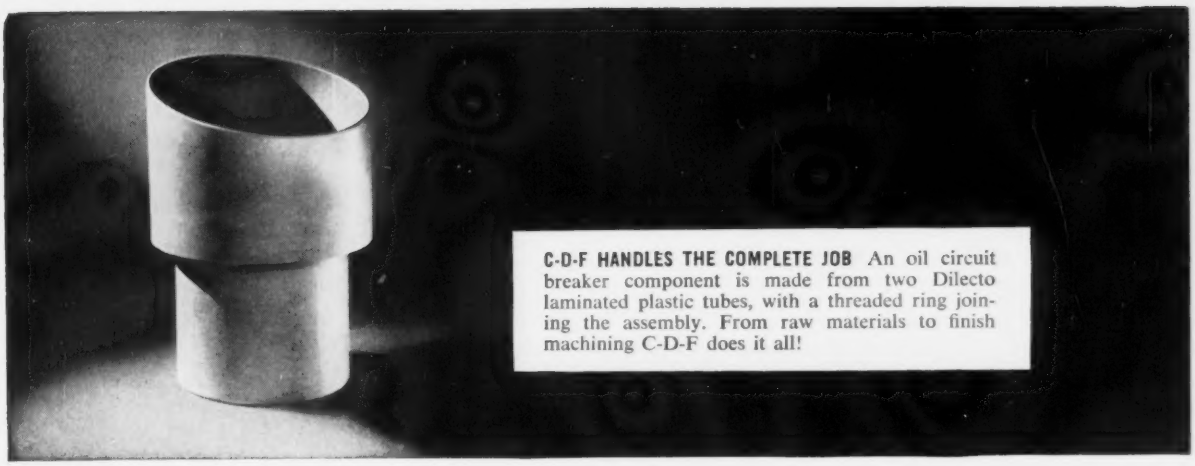
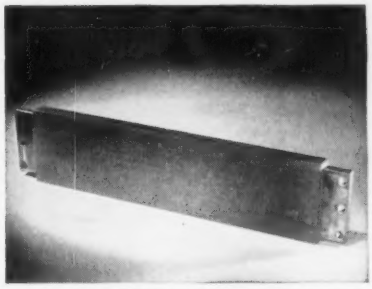
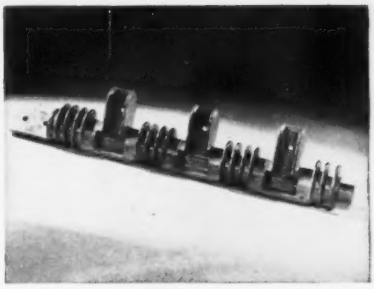


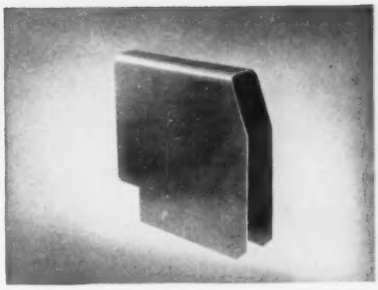
**C-D-F HANDLES THE COMPLETE JOB** An oil circuit breaker component is made from two Dilecto laminated plastic tubes, with a threaded ring joining the assembly. From raw materials to finish machining C-D-F does it all!



**C-D-F KNOWS HOW TO MACHINE PLASTICS.** A bus bar gets a covering of molded Dilecto over copper supplied by the customer. The plastic ends are skillfully trimmed on a smooth saw.

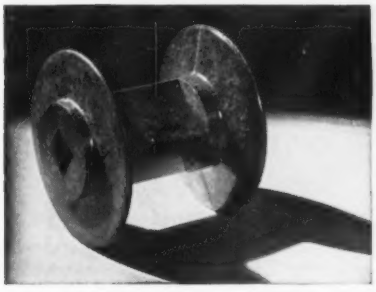


**C-D-F MOLDS MANY SPECIALTIES.** This shaft insulator for a circuit breaker is molded from C-D-F's cloth-based industrial thermosetting plastic, Celoron. Note complexity of mold, clean detailing.



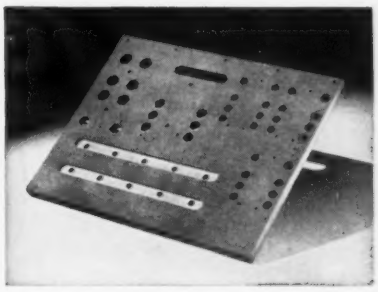
**C-D-F USES MODERN METHODS.** Large quantities of arc chute barriers are made from paper-based Dilecto. Operations include pressing, cutting, post-forming and trimming.

# Dependable equipment relies on C D F insulation!



**C-D-F OFFERS UNIQUE MATERIALS.** This contact shaft for an air circuit breaker is another example of molded C-D-F Celoron used in switchgear because of its high impact strength.

**C-D-F IS A SKILLFUL ASSEMBLER.** Made from Grade C rolled Dilecto tubing, these pots are turned, bored, slotted. Then a macerated plastic end is inserted and arc resistant varnish finish applied.

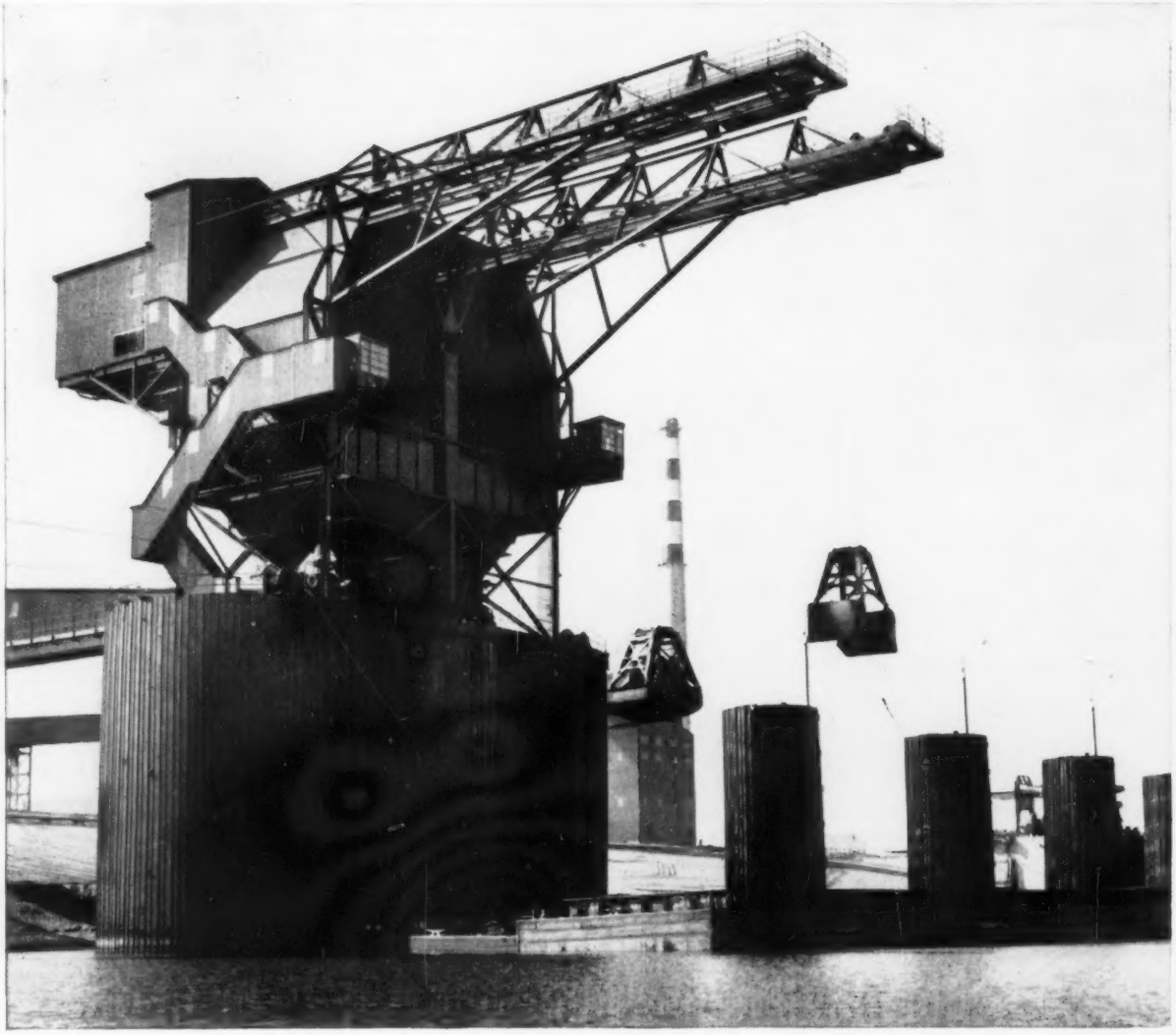


**C-D-F UNDERSTANDS THE ELECTRICAL INDUSTRY'S NEEDS.** Precisely machined to close tolerances, Dilecto panel boards guarantee dependable insulation, help designers save space.

See our catalog in Sweet's Design File for basic product data and sales offices. Write for detailed information, or send us your print for quotation.

**CONTINENTAL-DIAMOND FIBRE**

A SUBSIDIARY OF THE Budd COMPANY • NEWARK 15, DELAWARE



# Dravo builds world's largest coal unloading tower at Memphis

## New "Siamese twin" unloader serves 812,500-kw power plant

The world's largest coal unloading tower, designed and built by Dravo, is now serving the new 812,500-kw capacity Thos. H. Allen Generating Station at Memphis, Tenn.

This is the largest steam power plant ever authorized at one time by any municipality and was designed by Burns and Roe, Inc., of New York City, who also supervised plant construction.

Dubbed "the Siamese twins," the new unloader consists of two towers on a single base. Each of the two unloading units operates a 13.3-ton capacity bucket, with individual adjustable voltage control.

This unloader has a digging capacity of 2600 tons of coal an hour — 1300 tons per unit.

Separate welded, triangular booms are provided for each bucket trolley. Integrated design of the booms, with compression members into the tower, results in a structure of low height — 126 feet.

Find out more about how Dravo design and building know-how can help solve your coal or ship unloading problems. Contact DRAVO CORPORATION, Pittsburgh 25, Pennsylvania.

**DRAVO**
CORPORATION

**PART OF THE 14-MILE PERMALINE CONDUIT installation by Milwaukee Division of Wisconsin Telephone Company. The section shown is in Racine County. The installation, which carries principally intercity trunk lines, was laid in six- and eight-duct runs, in five-foot trenches, with four feet of cover. The L-M Flush-Fit couplings (arrows), which are the same outside diameter as the conduit, permitted a faster installation, requiring a minimum of concrete. This Permaline installation, made in 1956, has been completely trouble-free.**

# Two-Year Test Shows L-M Flush-Fit Couplings OK on Fibre Conduit

In the fall of 1956, Wisconsin Telephone Company laid a 14-mile run of L-M Permaline Conduit, consisting of six- and eight-duct runs carrying intercity trunk lines.

### Unusual Methods Speed Job

To speed up this installation, the contractors used L-M Flush-Fit couplings. These are tapered couplings with the same outside diameter as the conduit itself. They permit one conduit to be laid directly on top of another, doing away with vertical separation and resulting in considerable savings in concrete.

To maintain horizontal separation, wooden forks were used while the concrete envelope was poured. Upon completion of pouring, the forks were removed and reused.

### Get Data on Permaline

Permaline Conduit offers many advantages, such as smooth inner bore, consistent high quality, and the Permaline-engineered conduit system with complete procedure, couplings, bends, bell ends, and all other equipment for a fast, efficient installation. If desired, Permaline Conduit is available on skids, in fork-lift bundles, or in steel-strapped slings.

L-M Permaline is offered in sizes 2" through 6", in 5, 8, and 10-foot l-o-n-g lengths that save even more time. The most complete line of sizes and lengths. The most complete stocks—in 76 warehouses throughout the country. The largest number of L-M representatives and fibre products specialists to help you engineer your jobs.

Ask the L-M Field Engineer or specialist for free sample of Flush-Fit Coupling and information on this and Permaline Conduit; or write Line Material Industries, Milwaukee 1, Wisconsin, for a copy of L-M's 12-point plan folder and Bulletin UG1A. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

**THE L-M FLUSH-FIT tapered coupling is formed of light, strong POLYFLEXON plastic. Outside diameter is the same as that of the conduit, so there is no bulge or extra thickness at the joints. On request, L-M Permaline Conduit is shipped with an L-M Flush-Fit coupling attached at one end of each length—without extra charge.**

**LINE MATERIAL® Industries**

McGRAW-EDISON COMPANY

McGRAW EDISON

## Permaline Fibre Conduit

378-B

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

One of 12 L-M 161-kv, 1200 ampere PV switches in the Amelia, Texas, loop switching and bulk substation of Gulf States Utilities. This is a 30,000/50,000 kva station with 138-kv incoming and 69-kv outgoing sub-transmission lines. With minor structural changes, a second transformer of the same or larger size can be added to meet future load requirements.

# L-M High-Voltage Switches—Built Today To Serve Tomorrow's Growing Needs

## L-M Power Switching Equipment, the most recently designed line on the market, takes advantage of the latest developments in the science of switching, offers features far ahead of older switch lines.

by **W. V. SWAN,** Product Manager, Power Switching and Substation Equipment Line Material Industries

Six years ago Line Material began a complete redesign of its entire switch line. All traditional, time-worn practices were discarded. New ideas, based on the latest switch research and developments, were examined and thoroughly tested. The result is the most up-to-date line of power switching equipment on the market. We at Line Material feel that our switches offer many advantages over other switches still being made from original tooling.

### Check These Design Features

L-M Power Switches offer outstanding modern and exclusive features such as these:

- Smooth-operating ball bearings in blade guides and main bearings are lubricated with temperature-proof silicone grease, and sealed with silicone cord rings that resist temperature, oxidation, and corrosion indefinitely.
- Sealed current interchange utilizing a silver-plated beryllium copper spring enclosed in the blade-guide, instead of braid—a well-known potential source of trouble.
- Tremendous mechanical leverage to break ice and corrosion. The blade rotates 26 degrees to release itself before starting to rise more than a few degrees.
- High-pressure silver-to-silver contacts, with extra back-up copper to provide higher thermal capacity.
- Minimum number of current interchange points.
- Extremely flexible, easy-operating interphase mechanism with compensation for misalignment. Here, as with all other bearings and moving joint locations, silicone grease lubrication and silicone cord rings are used.

### Wide Choice of Switches

L-M Power Switching Equipment includes the following:

Type PV group-operated vertical-break switches for horizontal, vertical, or inverted mounting through 1200 amperes, 161-kv

Type PH horizontal-break switches through 1200 amperes, 115-kv

Type PES and PED single and double throw hook-operated disconnects through 1200 amperes, 69-kv

Type PHF multiple switch arrangements for vertical mounting on a single wood pole, with or without quick-break attachments, through 1200 amperes, 69-kv

A variety of accessories, including oil and air interrupters, quick-break attachments, tilting insulator switches, and a complete line of unique bus supports that provide wide interchangeability and thus greatly reduce inventory requirements.

### Let Us Give You Details

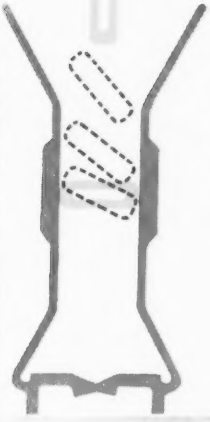
There are many more advantages of L-M's switch line—"built today to meet tomorrow's needs." Ask the L-M Field Engineer for bulletins and information; or write me at Line Material Industries, Milwaukee 1, Wisconsin.

**LINE MATERIAL® Industries**

McGRAW-EDISON COMPANY

## BLADE DESIGN AND ICE BREAKING ROTATION

Upper illustration shows cross sections of the heavy extruded copper blade. Lower illustrations show how the blade rotates 26 degrees to break ice and corrosion, and release contact pressure before beginning to rise.



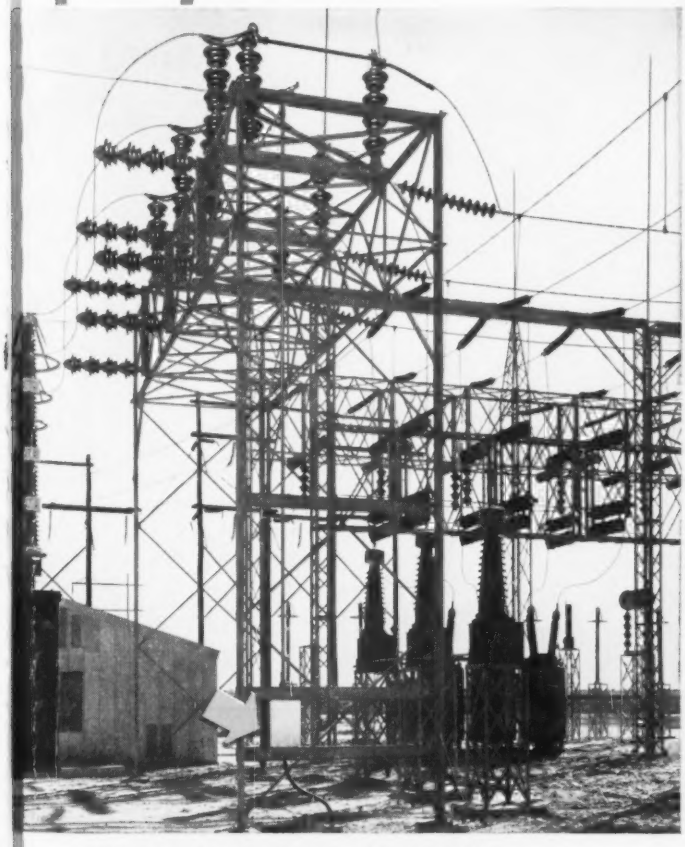
## SEALED CURRENT TRANSFER METHOD

Instead of carrying current through the bearings or braid at the hinge end, L-M switches employ a permanently sealed, lubricated low-resistance device designed by L-M. This consists of a silver-plated beryllium copper coil which provides an almost infinite number of high pressure contact points between the switch blade and blade guide, and also between blade guide and main frame casting.

*Ask for special bulletin No. 57077 on Sealed Current Transfer Method.*

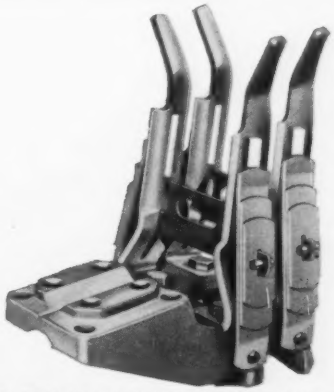
## BALL BEARINGS WITH SILICONE CORD RING SEALS

Smoothly operating ball bearings are lubricated for life with temperature-proof silicone grease, and completely and permanently sealed with silicone cord rings which are unaffected by temperature changes, oxidation, or corrosion.



## MOTOR-OPERATED SWITCH

L-M motor-operated 161-kv, 1200 ampere PV switch. The silicone-ring-sealed ball bearings and easy-operating interphase mechanism make it very easy to operate this big 3-phase switch.



## HIGH-PRESSURE CONTACTS PRE-LOADED TO 175 POUNDS

Jaw contact assembly. Large hard-drawn copper shoes have silver inserts. Six heavy leaf springs held by tie-bar maintain uniform 175-pound pressure on the contacts. The tie-bar permits accurate and permanent factory adjustment of contact pressure.

Power Switching Equipment

McGRAW EDISON



DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
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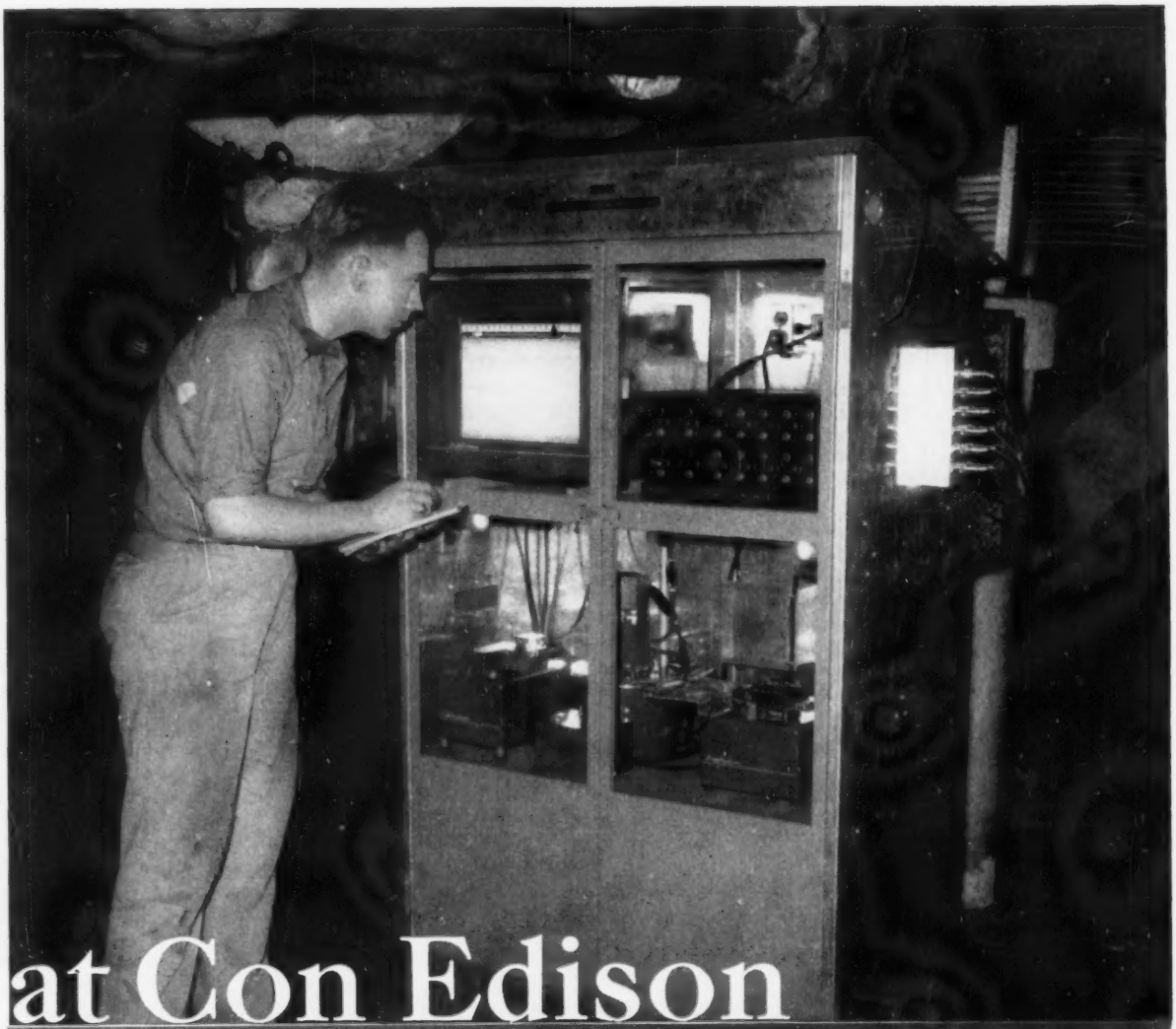


# at Con Edison

## CONTINUOUS AUTOMATIC ANALYSES OF BOILER FEED WATER with the TECHNICON® AutoAnalyzer®

Continuous automatic sampling and analysis of feed water for ten steam generating units, in cycles hundreds of times a day. In other control stations, AutoAnalyzers perform similar functions providing continuous chemical analyses without attendance. Precisely measures trace materials down to parts per billion ±1%.

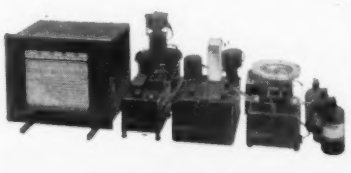
*To receive your copy of the free AutoAnalyzer brochure plus specific application data, simply fill in the coupon below. No obligation, of course.*

TECHNICON CONTROLS, INC., 200 Saw Mill River Parkway, Chauncey, N.Y.
Gentlemen: Please send me the TECHNICON AUTOANALYZER BROCHURE plus other pertinent data.

NAME_____ TITLE_____

FIRM_____ STREET_____

CITY_____ ZONE_____ STATE_____



**TECHNICON CONTROLS, INC., Chauncey, New York**

*This is the tower that has*

## *UNUSUAL DURABILITY*
## *HIGH LEVEL DISCHARGE*
## *BIG PLANT CAPACITY*

*. . . that's what makes*

# MARLEY-MOUCHEL HYPERBOLIC

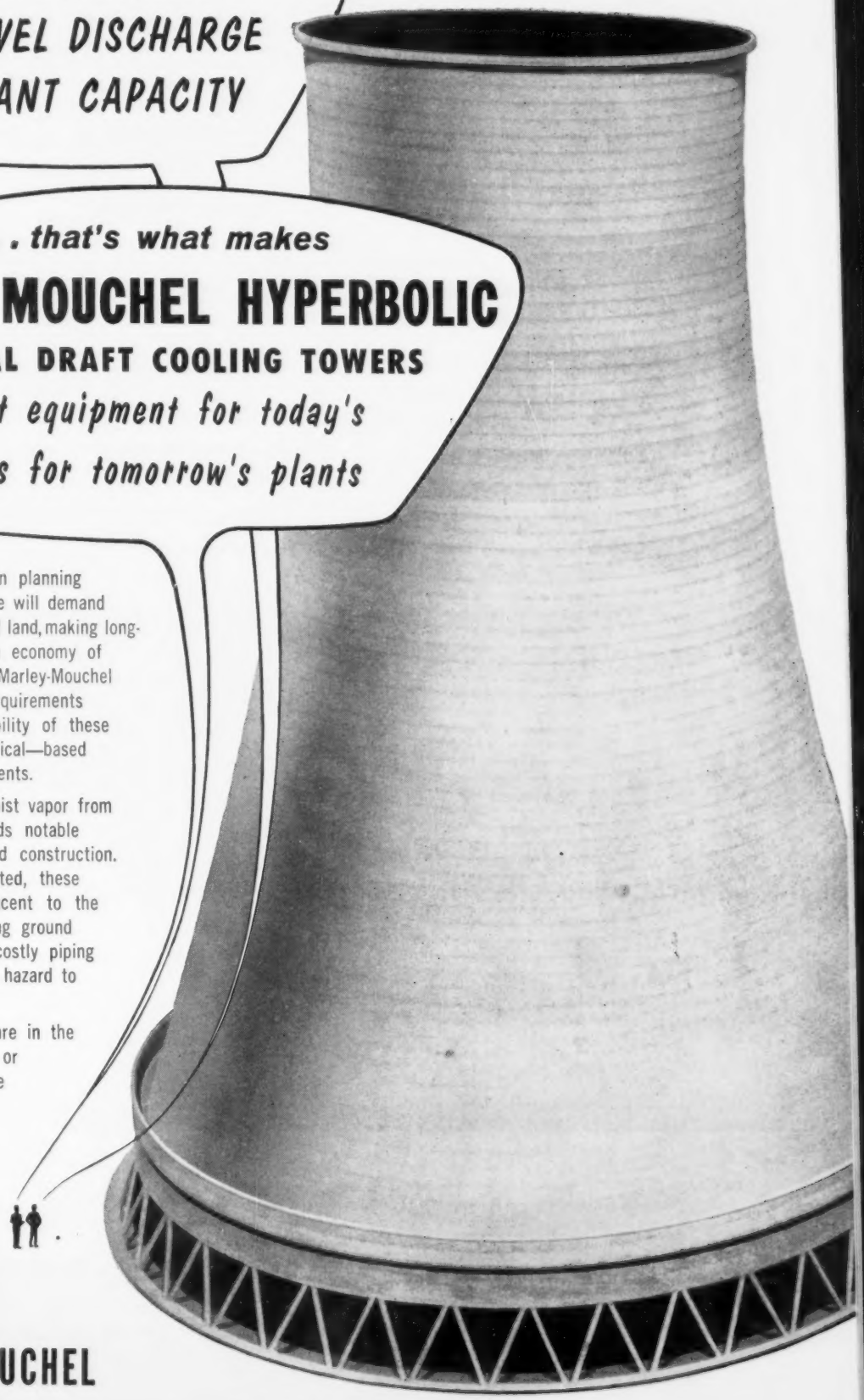
## NATURAL DRAFT COOLING TOWERS

*perfect equipment for today's designs for tomorrow's plants*

Generating stations now in planning stage and those of the future will demand larger investment in plant and land, making long-term amortization and space economy of paramount importance. The Marley-Mouchel concrete tower fits these requirements precisely. The rugged durability of these natural draft towers is historical—based on experience on four continents.

High level discharge of moist vapor from Marley-Mouchel towers affords notable economies in plant area and construction. With ground fogging eliminated, these towers can be located adjacent to the machines they serve, reducing ground requirements by acres and costly piping by thousands of feet without hazard to plant equipment or traffic.

Particularly if your plans are in the 100 mgw production range or larger, you should investigate Marley-Mouchel Hyperbolics; they have the capacity per unit to match large scale generating equipment.



MARLEY MOUCHEL

The Marley Company

# SILICONE RUBBER INSULATED
# *BY ROCKBESTOS*
# OFFER YOU:

**Excellent dielectric strength** — electrical properties remain constant from −130°F to +500°F.

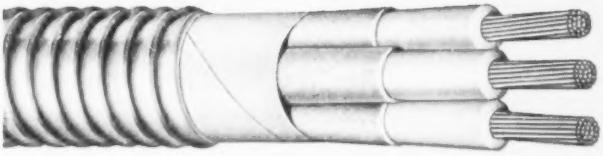
**High heat resistance** — better than any type rubber insulation. Long service life in temperatures to 125°C (power cables) and 200°C (other applications).

**Excellent moisture resistance** — unrestricted applications in wet or dry locations — equal to the best grades of rubber. No lead sheath required.

**Greater ozone resistance** than the best grades of rubber insulated cables.

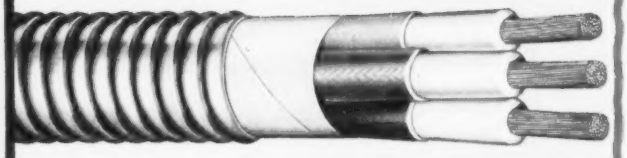
**Excellent resistance to chemical attack** — being chemically inert, silicone rubber insulations resist effects of lubricating oils and most corrosive atmospheres.

**Long life** — excellent resistance to weathering and aging.



### *600 and 5000 VOLT MULTI-CONDUCTOR POWER CABLE*

Silicone rubber insulated power cable combined in a 3 or 4 conductor construction, with interlocked armor overall . . . easily installed with simple supports . . . eliminates conduit . . . greater current carrying capacity for economical power distribution.



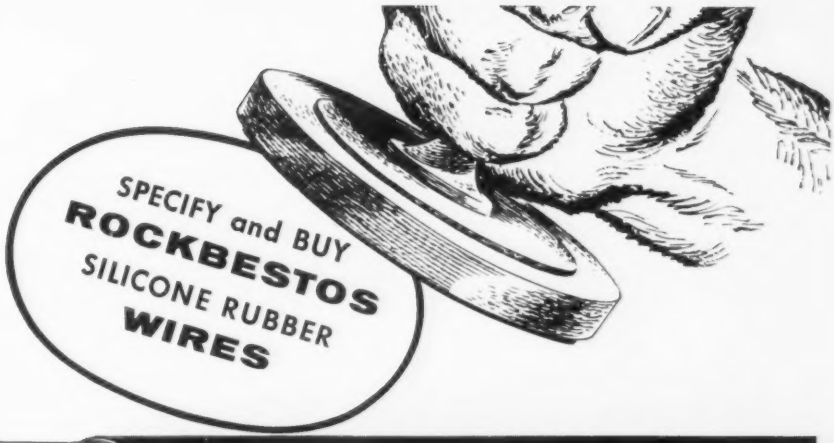
### *MULTI-CONDUCTOR CONTROL CABLE*

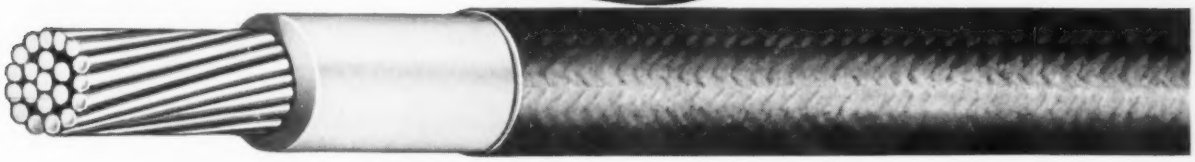
For use in steel mills, power stations, boiler rooms, automotive, ceramic and glass plants as well as other industries where control and signal circuits or control equipment are exposed to high ambient operating temperatures.

**ROCKBESTOS PRODUCTS CORPORATION, NEW HAVEN 4, CONNECTICUT**

NEW YORK • CLEVELAND • DETROIT • CHICAGO • PITTSBURGH • ST. LOUIS • ATLANTA • DALLAS
SEATTLE • LOS ANGELES • BURLINGAME, CALIFORNIA

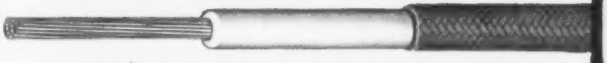
# WIRES



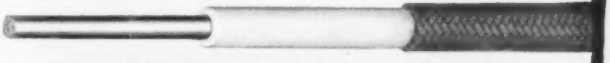
## SILICONE RUBBER INSULATED POWER CABLE 600 and 5000 VOLTS

For high temperature circuits either in wet or dry locations, exposed or in conduit. This cable is recommended for use in steel mills, power stations, heat treat areas, boiler rooms, foundries, smelters, etc.



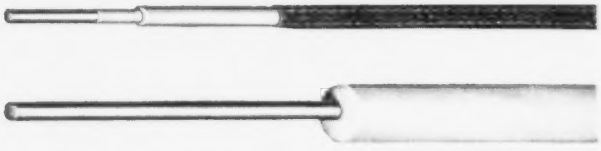
## MOTOR LEAD and APPARATUS WIRES

For leads to motors, transformers, etc., requiring a flexible wire in high temperature locations or applications.



## APPLIANCE and FIXTURE WIRES

For use in wiring high wattage units when operating temperatures reach 150°C and 200°C. Lighting fixtures, clothes dryers, electronic equipment, stoves, water heaters, ovens, therapeutic devices, space heaters are among the many products for which these wires are recommended.

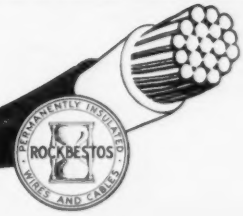


## HEATING CABLES and DEFROSTING WIRES

Heating cables are ideal for use in pipe heating, surface heating, roof de-icing and soil heating.

Defroster wires being odorless and tasteless are perfect for use as rapid defroster heating element in electric refrigerators and freezers.

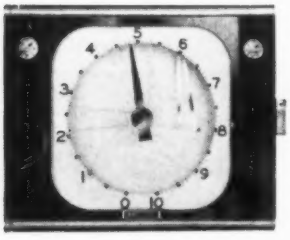
# ROCKBESTOS




*For complete details on Rockbestos Silicone Rubber Insulated Wires and Cables send for Catalog SR58.*

## Bristol's 7-point coast-to-coast field service

***Helps you from the time you start thinking instruments – through installation – for as long as the job requires***



**A Bristol Field Engineer** is the man to call when you first start thinking about instrumentation. Located in a nearby Bristol office (they blanket the U.S. and Canada) he calls at your plant to assist you in planning your proposed installation. No obligation.

**Application Engineers,** specialists in the abilities and limitations of every type of instrument, and Process Specialists, experts in instrumentation techniques in varied fields can be called in where necessary. They insure you the right instrument, installation and operation for your specific job.

**Service Engineers** to keep your instruments operating perfectly are "on call" often within a few hours. They install, check and adjust instruments in your plant.

**Periodic Check-up Service** at regular intervals is also available.

**Bristol's Instrumentation Schools** for customer engineers help train your own technicians in instrument operation and maintenance.

**Factory Repair Service** at San Francisco, Los Angeles, Chicago, Houston, Waterbury and Toronto has all facilities, parts, experience to properly repair, recondition and remodel Bristol instruments. Each instrument reconditioned carries a new instrument warranty.

**Fast Parts Service** is assured by the Bristol practice of stocking service parts that may be needed in emergencies in all 38 Branch offices. You get fast action from a near-by source.

These big extras you get with Bristol instruments are good reasons—over and above outstanding basic instrument quality—why every Bristol installation gives such high accuracy and precision performance over an extremely long service life. To find out more about Bristol instruments or service, write: The Bristol Company, 116 Bristol Road, Waterbury 20, Conn. B.17

**BRISTOL** TRAIL-BLAZERS IN PROCESS AUTOMATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

# RT&E

Concentration on distribution transformers only has led RT&E to superior engineering achievement in every phase of transformer development.

One outstanding example of such achievement is clearly evident in R T & E transformer insulation. Because insulation is so important in over-all transformer performance, R T & E impulse withstand levels exceed NEMA requirements by as much as 50%. In addition, R T & E transformers can be safely overloaded without exceeding NEMA temperature rise limitations.

*engineering talent concentrated on transformer*

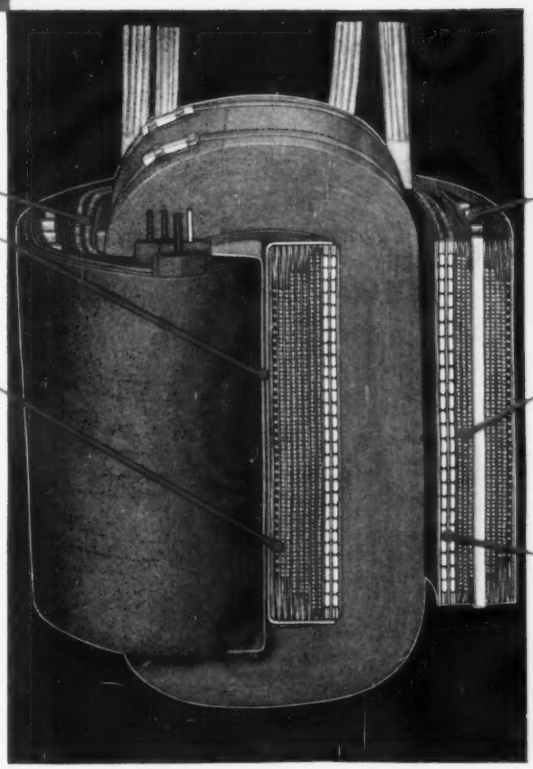
# insulation

## *assures higher overload capacity, extra surge strength*

**COIL LAYER INSULATION**
A minimum of two sheets per layer of high grade 100% pure Kraft electrical paper is used. Thickness choice is such that a maximum stress of 30 volts per mil thickness is attained at high stress points. Major insulation is used as a barrier between primary and secondary windings. Heavy transformer board is used as a barrier between secondary windings and the core.

**SURGE PROTECTION**
All coils are protected against lightning and switching surges. This is accomplished by means of a space wound layer which resists turn to turn failures and by stepping back the end turns of coil layers and locking them in place with folded paper insulation. This provides a high factor of safety in creepage distances and offers a high resistance to winding to ground or secondary lightning punctures.

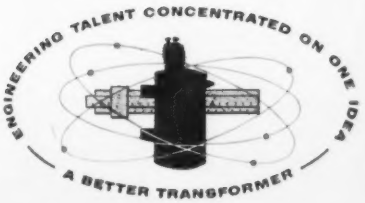
**VARNISH**
To further enhance the mechanical and electrical strength of the coil, it is immersed in a high solids, high mechanical strength thermosetting varnish that will not soften, dissolve, or affect the cooling oil. After thorough penetration by this varnish, the coils are baked to assure complete curing of varnish and to remove moisture. Final coil drying is done under heat and vacuum in the transformer tank before the oil is added.



**INHIBITED OIL**
The finest mineral oil, inhibited with DBPC, is used in all R T & E transformers, but only after it has gone through a special drying and filtering process to maintain a dielectric strength of at least 30,000 volts breakdown when tested according to ASTM standards.

**TURNS INSULATION**
Primary (high voltage) turns are round-wire, insulated with heavy Formvar which has excellent electrical properties, resistance to bending abrasion and heat, and is chemically stable.

Secondary (low voltage) turns use rectangular or square conductors, and are either double cotton or ¾ lap paper insulated. This insulation has excellent varnish absorption qualities which enhance the mechanical and insulating qualities of the coil.




**RT&E CORPORATION**
WAUKESHA, WISCONSIN • PORTLAND, OREGON

ANACONDA
ABB

# THERE IS A DIFFERENCE IN ACSR

## ...and that difference is cable experience!

There is a priceless ingredient in Anaconda ACSR – *cable experience!* More than 50 years' work with transmission cable of all types. Designing, testing, manufacturing. Field consultations on hundreds of complex jobs.

You'll find Anaconda's cable experience shows up in many ways: longer trouble-free performance by the cable itself, practical suggestions by Anaconda's field engineers that may save you time and money.

So—before you start your next job—it will pay you to talk to the Man from Anaconda.

Backed by the broadest line of wire and cable in the industry, in both copper and aluminum, he is qualified to help you arrive at the most practical and economical answer to your cable needs.

Multi-mill manufacturing facilities – strategically located across the country – assure speedy service. Write or call today! Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

Pictured at left: high-voltage transmission line of Anaconda ACSR being strung in the Northwest.

ASK THE MAN FROM

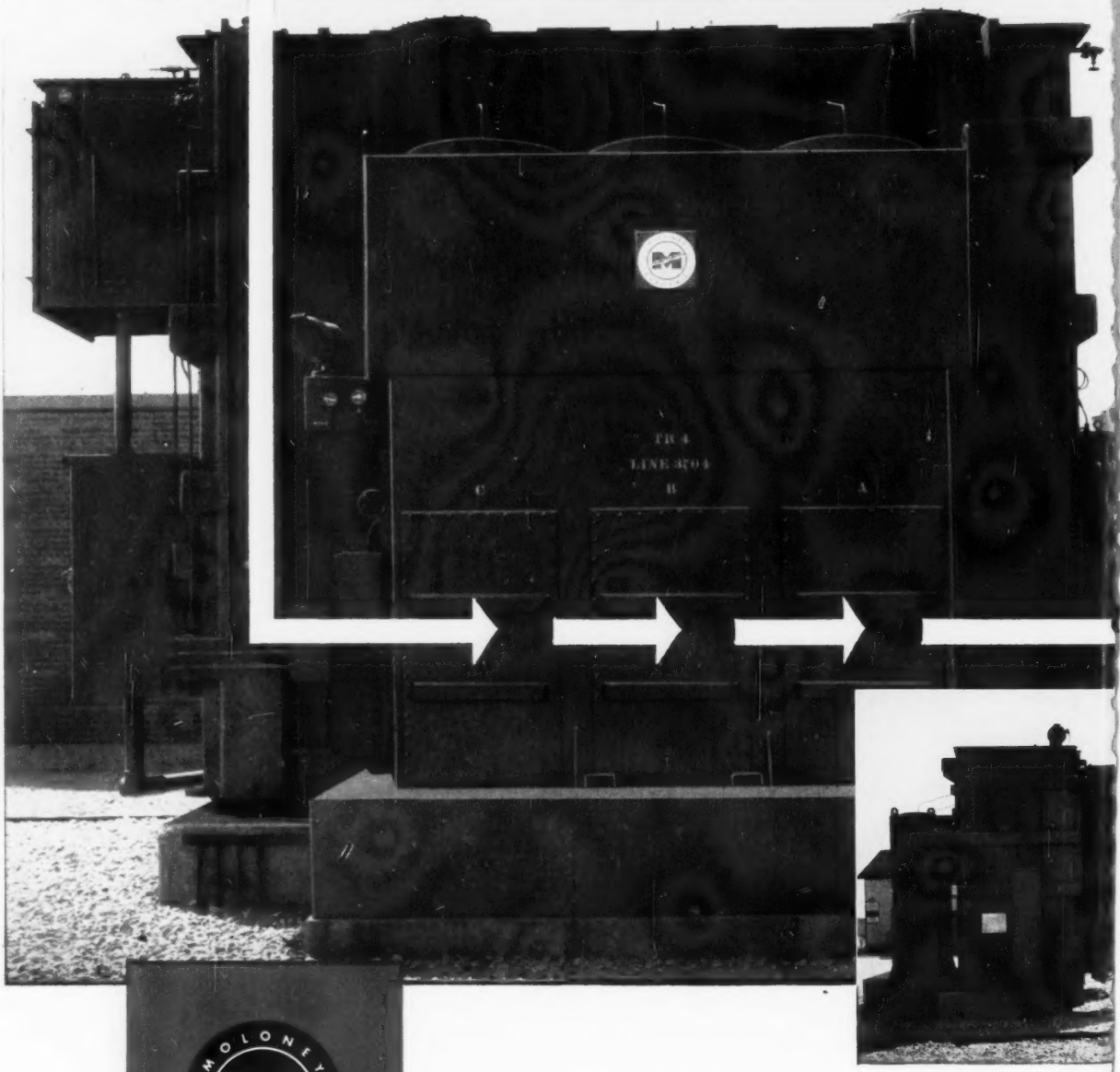
# ANACONDA®

FOR

**ALUMINUM WIRE AND CABLE**

LIVE BETTER ELECTRICALLY

# 138 KV TERMINAL COMPARTMENTS TERMINATE HIGH PRESSURE PIPE TYPE CABLES ON COMMONWEALTH EDISON COMPANY TRANSFORMERS



**MOLONEY ELECTRIC**

*Manufacturers of Transformers for Utilities, Industry,*

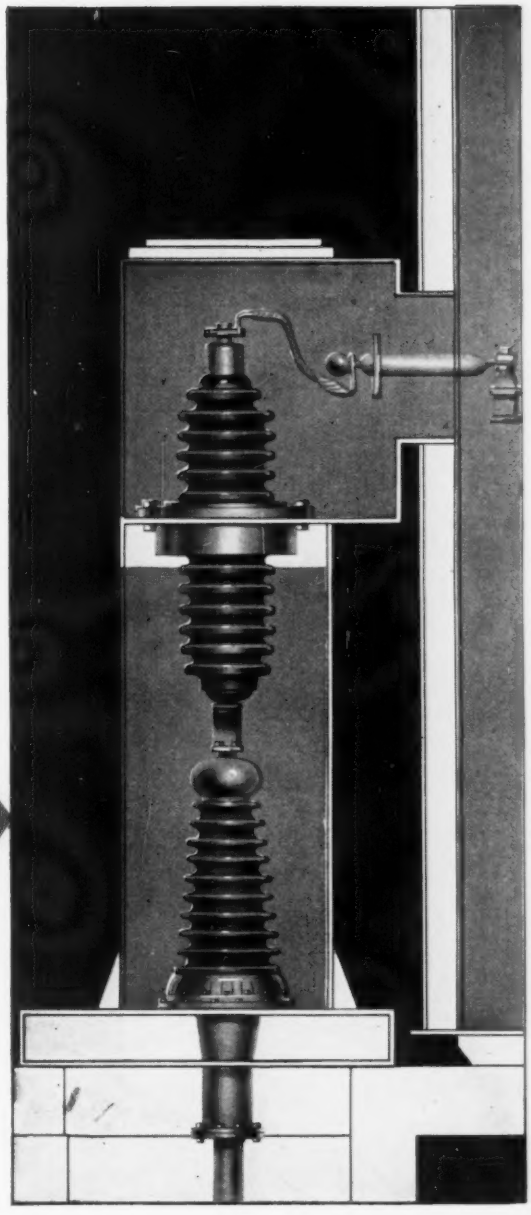
**SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES**

## Provide Positive Isolation Of Cable Oil From Transformer In Event Of Cable Termination Leaks

To provide service in some areas of Chicago, Commonwealth Edison Company uses 138 KV lines, located underground, and therefore, 138 KV 200 PSI high-pressure, oil-filled cables are used.

Termination of a 138 KV line at a transformer presents the problem of preventing the cable oil from becoming mixed with the transformer oil in the event of a failure or a leak at the high voltage pothead termination. An effective solution to this problem is the two-compartment terminal chamber developed by Moloney in cooperation with Commonwealth Edison Company.

The upper compartment of the terminal chamber is attached to the transformer tank wall. Electrical connections from the transformer coils to barrier bushings installed in a partition between the upper and lower compartments of this terminal chamber are made through openings in the tank wall with transformer oil common to both the transformer tank and this upper terminal compartment. The lower compartment houses the high voltage potheads which are electrically connected to the lower terminals of the barrier bushings. This lower compartment is also filled with transformer oil and is equipped with a pressure relief vent, as well as a pressure-vacuum gauge and an oil level gauge having alarm contacts. Phase barriers are placed between the potheads.



In the case of even a slight leak of cable oil into the lower compartment, the pressure-vacuum gauge or the oil gauge will give indication of this condition and when the pressure or oil level reaches a predetermined point an alarm will be actuated. In event of an extremely bad leak the pressure relief vent will discharge excess oil.

Once again, Moloney, in cooperation with a customer, has developed a satisfactory answer to one of the day-to-day problems confronting the utilities.

Whatever your transformer problem, contact your Moloney representative for the benefit of more than sixty years experience in solving problems related to the design, manufacture and application of transformers. MES8-28

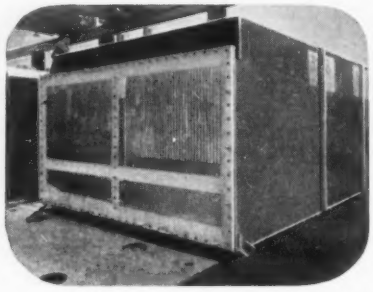
**COMPANY**

*and Electronic Applications*

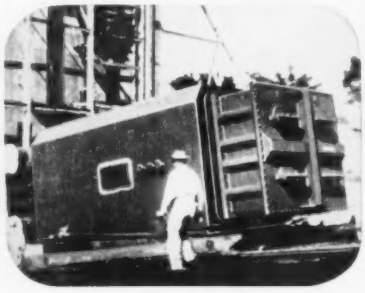
**AT ST. LOUIS 20, AND TORONTO, ONT., CANADA**

*and auxiliary equipment*

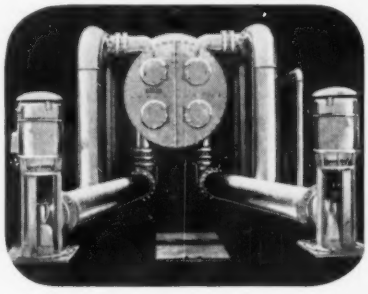
# HOW C.H. WHEELER CONDENSER DESIGN saves space...



**Head Room** problems are solved by compact condensers like this one. Turbine floor to basement floor, in this case, is only 20 ft. The Unit has 65,000 square feet of condensing surface.

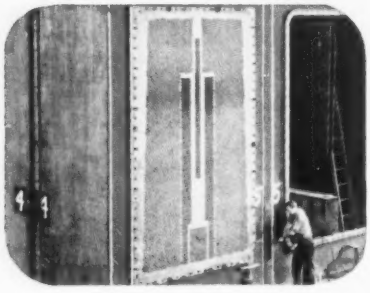


**Rectangular Cross Section** makes C.H. Wheeler Condensers adaptable to nearly any space or condenser arrangement because the length, width and height of any Wheeler Unit can be varied almost at will.

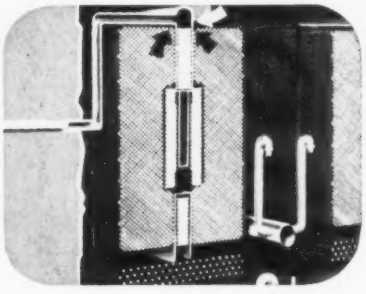


**But Wheeler Doesn't** limit itself to rectangular design. A round cross section worked out better here, for example, at the first planned gas-steam turbine station ever designed and built in United States.

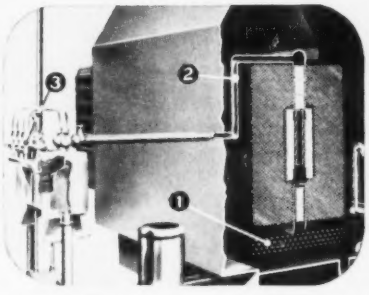
## improves power generating efficiencies...



**Triple Lane tube layout,** another design feature, provides 3 pathways for steam travel, utilizes maximum cooling surface and produces higher condenser vacuums for power generating stations.

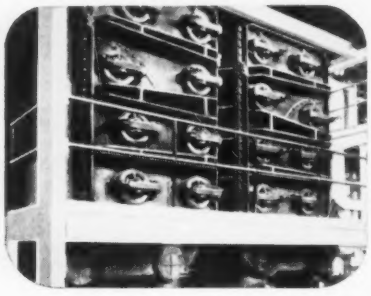


**Location of air-vapor takeoff** speeds steam travel and allows steam to penetrate to the peripheries of all tubes. It thus improves condenser efficiencies and overall power station operation as well.

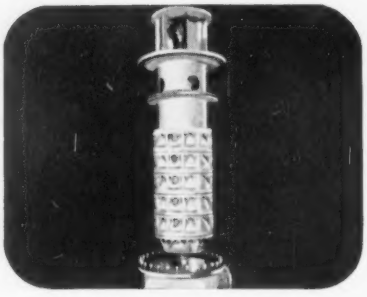



**Deaeration of condensate** not to exceed 0.01 cc. oxygen/liter is available with special Wheeler designs. Note the Deaerating Bars (1), the Air-Vapor Suction Line (2), and Tubejet® Ejectors (3).

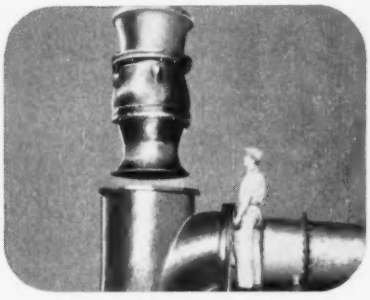
## and reduces maintenance



**Patented Reverse Flow** permits flushing tubes and sheets without shutting down Unit, during full load with either or both circulating pumps operating. No additional circulating water inlet or discharge piping necessary with C.H. Wheeler's Reverse Flow.



**"Pull-Out" Condensate Pumps** simplify maintenance because entire pumping element, including all rotating parts, can be removed without disturbing either the pump barrel or the piping connections.



**C. H. Wheeler Circulating Pumps,** like Condensate Pumps, are easy to inspect and maintain because of "Pull-Out" design. In addition, shafts are heat treated alloy steel and impellers are statically and dynamically balanced for trouble-free operation.

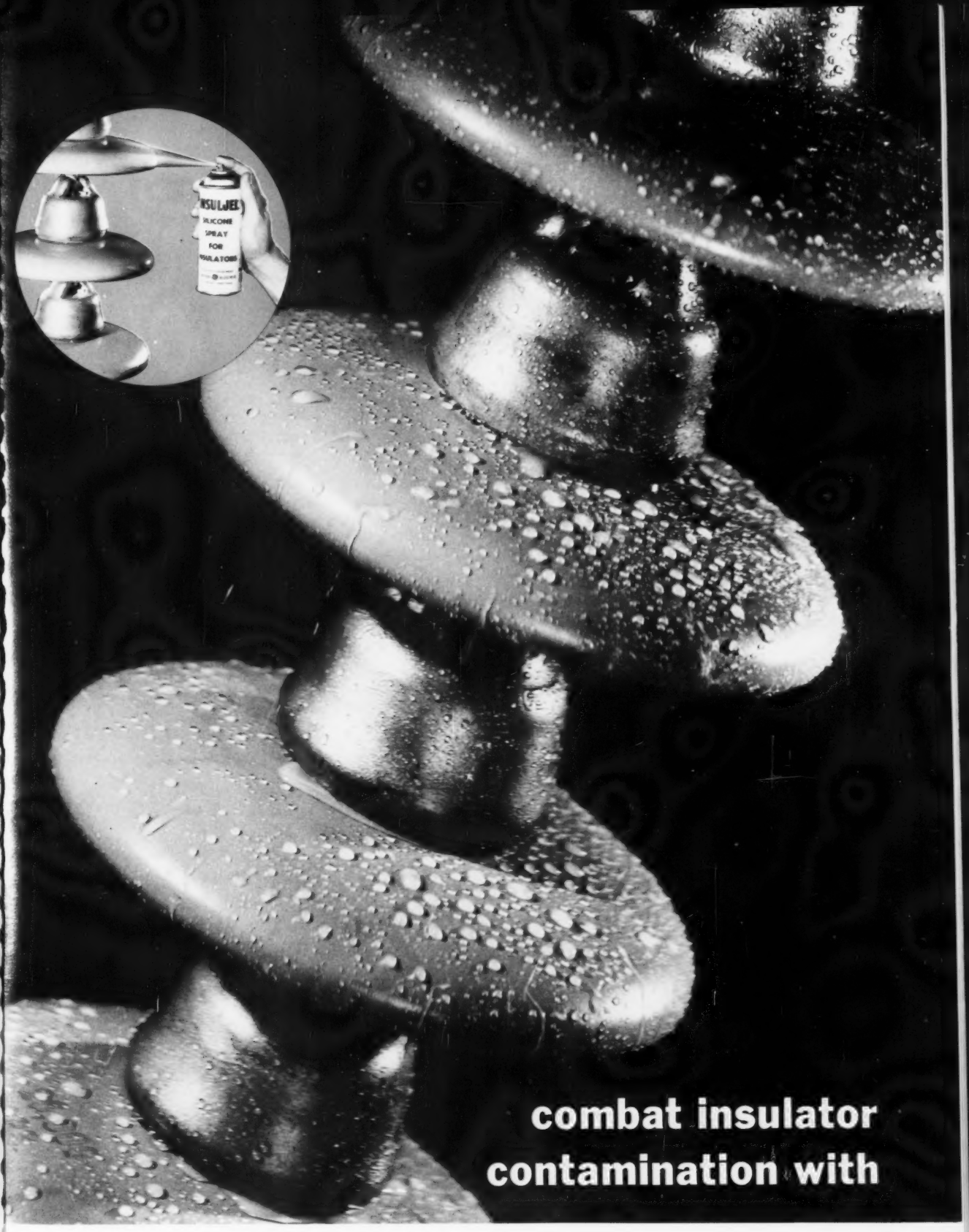
C. H. Wheeler has been designing and building condensers since 1903; has developed such features as Dual Bank Design and Reverse Flow.

## C. H. WHEELER MFG. CO.

19TH & LEHIGH AVENUE
Philadelphia 32, Pennsylvania

*Whenever you see the name C. H. Wheeler on a product, you know it's a quality product*

**Steam Condensers • Steam Jet Vacuum Equipment • Centrifugal, Axial and Mixed Flow Pumps • Marine Auxiliary Machinery • Nuclear Products**

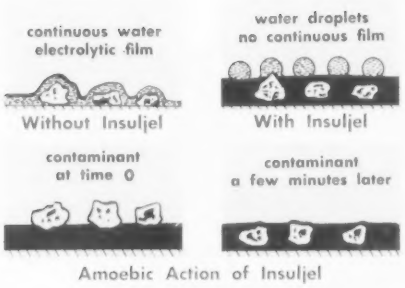



combat insulator
contamination with

# INSULJEL

# what is INSULJEL*

INSULJEL is a silicone grease† dispersed in a quickly evaporating vehicle. It has been designed to improve insulator electrical wet characteristics through its water shedding and amoebic action.



Amoebic Action of Insuljel

### INSULJEL—WATER REPELLENT

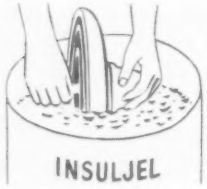
Applied to insulator surfaces, the solvent in INSULJEL evaporates, leaving a protective grease coating. Moisture "bunches" into separate droplets. These droplets, in contact with any of the soluble contaminants, are restricted from forming a continuous electrolytic film on the insulator surface. Low resistant paths are broken up, hampering the formation of excessively distorted voltage gradients across the insulator.

†INSULGREASE* is the silicone grease contained in INSULJEL and is available in paste form for special application.

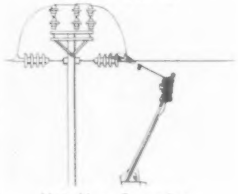
### INSULJEL—AMOEBIC ACTION

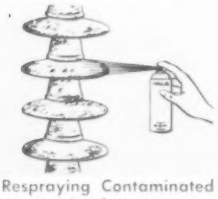
Particles deposited on the grease surface formed by INSULJEL are engulfed by amoebic action. Each particle is permanently sealed against contact with moisture. This prevents the soluble contaminants from becoming electrolytes, and restricts their contributing to low electrical characteristics during periods of rain, dew, or fog.

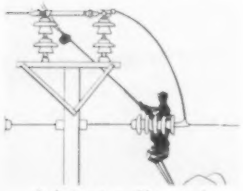
# why is INSULJEL important to you



Hand Dipping


Hot Line Spraying


Respraying Contaminated Insulators


Lubricating Electrical Equipment

INSULJEL proves an ideal solution to insulator contamination problems through a combination of excellent water shedding and engulfment properties. Its convenient liquid form and fast evaporating solvent provide money and labor saving advantages. Compare these benefits with those offered by other insulator anti-contaminants.

INSULJEL, because of its amoebic action, restores itself in the event of lightning or surge flashovers. Any charred contamination particles resulting from a lightning flashover are quickly engulfed in the surrounding grease.

INSULJEL sprayed or dipped applies a protective silicone coating quickly, easily, evenly. No expensive globs of grease packed into petticoats or undercuts.

INSULJEL's hot line application eliminates tedious hand spreading, saves on cleaning preparations, provides service continuity.

INSULJEL can be reapplied one coating over another. Cleaning when desired is quick and easy, with most high dielectric petroleum base solvents.

INSULJEL is an excellent lubricant for switch, disconnect , and other electrical equipment. INSULJEL lubricates operating mechanisms, restricts metallic corrosion, provides smooth non-stick operation at below —40°F.

INSULJEL is available in a number of convenient size containers . . .

16 ounce Aerosol Spray
1 gallon Fluid Bulk
5 gallon Fluid Bulk
50 gallon Fluid Bulk

Publication TIA-166 will give you additional information on INSULJEL and INSULGREASE. For copies, write to Insulator Department, General Electric Company, P. O. Box 57, Baltimore 3, Maryland.

**Save Money and Labor, Specify INSULJEL.**

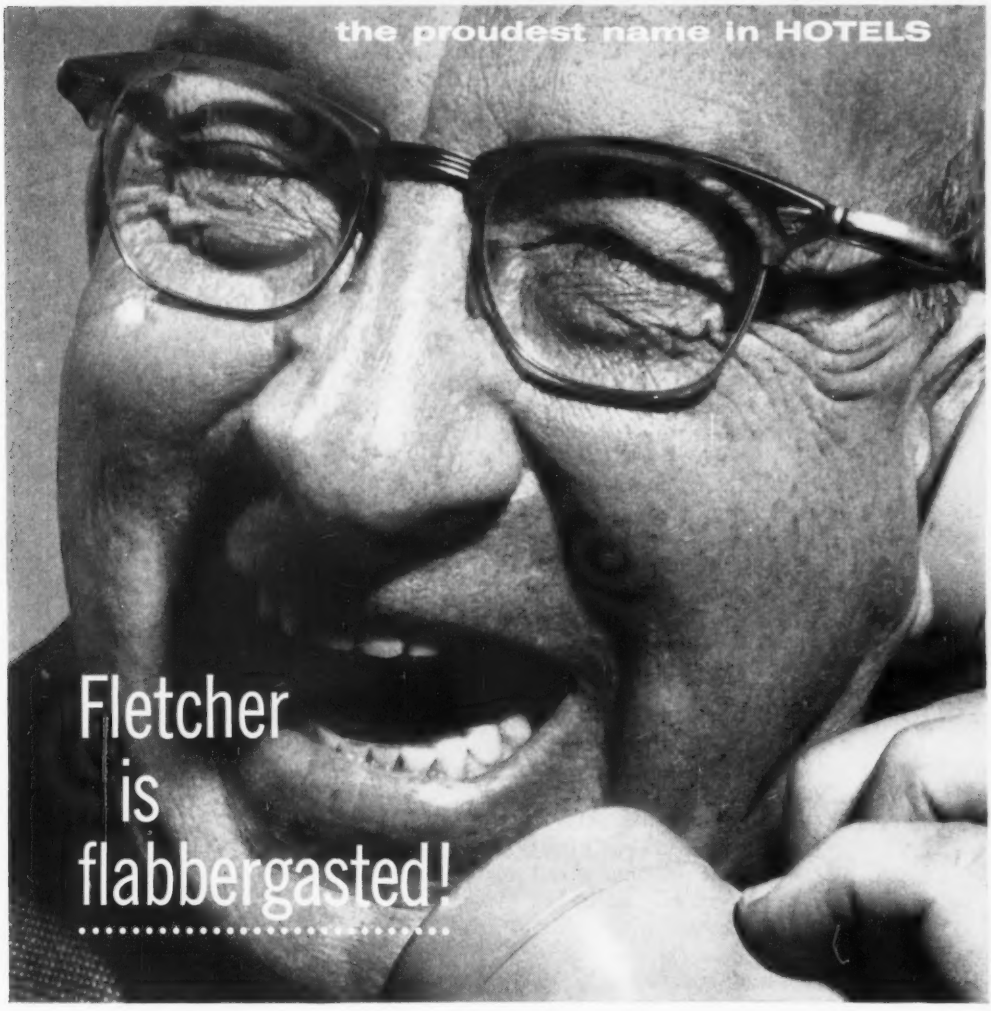
*Trademark of General Electric Company

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

# SHERATON

the proudest name in HOTELS




**Which of these 39 cities is your next stop?**

**EAST**
NEW YORK
BOSTON
WASHINGTON
PITTSBURGH
BALTIMORE
PHILADELPHIA
PROVIDENCE
ATLANTIC CITY
SPRINGFIELD, Mass.
ALBANY
ROCHESTER
BUFFALO
SYRACUSE
BINGHAMTON, N.Y.
(opens early 1959)

**MIDWEST**
CHICAGO
DETROIT
CLEVELAND
CINCINNATI
ST. LOUIS
OMAHA
AKRON
INDIANAPOLIS
FRENCH LICK, Ind.
RAPID CITY, S. D.
SIOUX CITY, Iowa
SIOUX FALLS, S. D.
CEDAR RAPIDS, Iowa

**SOUTH**
LOUISVILLE
DALLAS
(opens early 1959)
AUSTIN
MOBILE

**WEST COAST**
SAN FRANCISCO
LOS ANGELES
PASADENA
PORTLAND, Oregon
(opens fall 1959)

**CANADA**
MONTREAL
TORONTO
NIAGARA FALLS, Ont.
HAMILTON, Ont.

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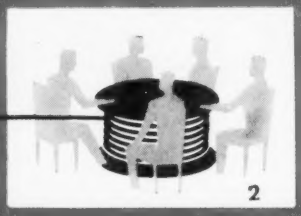
*City* ..... *Zone* ..... *State* .....

DU PONT

# WIRE AND CABLE ROUND TABLE



2

## You have asked . . .

**Q: What is the straight story on the flammability of polyethylene?**

**A:** Polyethylene is rated as a "slow-burning" material, like rubber and many other materials. Its performance in flame tests depends on the construction. For instance, #6 AWG copper line wire with 2/64" of ALATHON 5, BK22 polyethylene resin passes the horizontal flame test. If you need a truly "self-extinguishing" insulation which will pass the U/L vertical flame test, use Du Pont RULAN flame-retardant plastic (based on polyethylene).

**Q: What is the best nylon and best polyethylene for outdoor service? How long will they last?**

**A:** The best outdoor nylon is ZYTEL 37X nylon resin. It contains well-dispersed carbon black, and a good heat stabilizer. We do not know yet what its outdoor life will be, but it has stood up over 7,000 hours in the Weather-O-Meter (unfiltered arc) without failure.

ALATHON 4 BK-30 is Du Pont's best polyethylene resin for outdoor service. It should be good for well over 20 years (possibly over 40).

**Q: I have had trouble with thermoplastic jackets splitting and jamming conduits during pulling. Do you know a good lubricant?**

**A:** Maybe you're using the wrong thermoplastic. We are having great success with jackets of ZYTEL 37X. This product is extremely hard and slick, exceptionally tough, easy to pull. 37X looks good for direct burial cable, too, where you have especially tough plowing conditions.

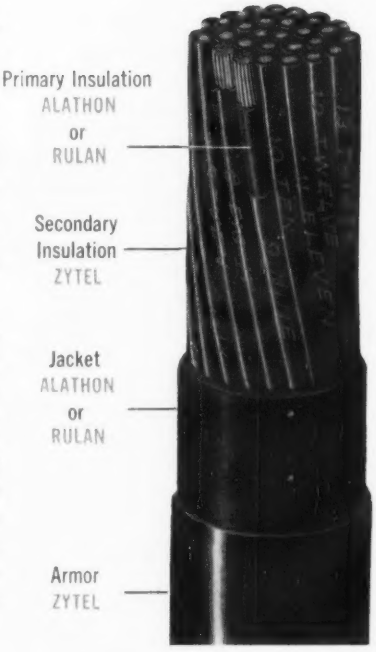
---

Du Pont does not manufacture wire and cable, but supplies thermoplastic resins for insulation and jacketing.

# Save 20-35% installation space with Du Pont plastics

Extensive research has shown that the properties of ALATHON polyethylene resins permit a thinner primary insulation with equal or better dielectric performance than other compounds. Result: smaller over-all cable diameter and smaller conduits are practical. Depending on the number and size of conductors, savings of 20% to 35% in thickness over the older constructions are thus possible.

For extreme cases, where the possibility of fire precludes the use of polyethylene, Du Pont recommends the use of RULAN, a flame-retardant plastic, in the same thickness as ALATHON. For secondary insulation, a thin skin of ZYTEL nylon resin imparts exceptional abrasion resistance and higher operating temperature limit. Where mechanical abuse or chemical attack pose a problem, an armor of ZYTEL gives maximum protection.




A typical control cable design that takes advantage of the superior properties of Du Pont plastics is shown at right. For complete information on the use of ALATHON, RULAN and ZYTEL for improving signal and control cable design, send for your copy of Polychemicals Department Booklet WC-3 "Signal and Control Cable Design." Clip the Round Table symbol from the top of this ad and send it with your name and address to: Du Pont Company, Rm. 172, Polychemicals Dept., Wilmington 98, Del. *In Canada:* Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

POLYCHEMICALS DEPARTMENT

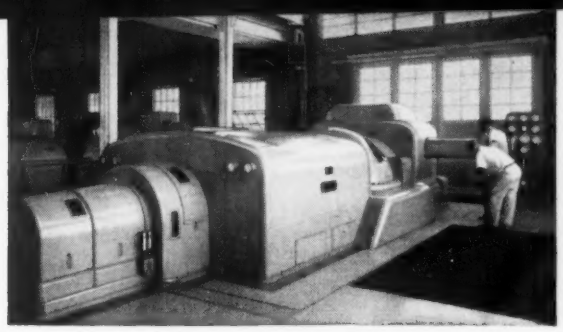
DU PONT

Better Things for Better Living . . . *through Chemistry*

**ALATHON®** POLYETHYLENE RESINS | **RULAN®** FLAME RETARDANT PLASTICS | **ZYTEL®** NYLON RESINS

# One reason why Fairfield, Illinois has efficient electric service-

# Nonpareil Turbine Oil



Plant superintendent James Easton and Standard Oil industrial lubrication specialist Charlie Brown inspect 5,000 kw. Worthington turbine, one of four turbines in Fairfield Municipal Light & Power Company plant lubricated with NONPAREIL Turbine Oil.

These turbine installations trace the record of growth in electric power consumption in Fairfield, Illinois, over the past 19 years:

| Type | Turbine Cap. | Installed |
|---|---|---|
| Westinghouse | 1,500 kw. | March, 1940 |
| Westinghouse | 2,500 kw. | March, 1942 |
| Westinghouse | 4,000 kw. | March, 1949 |
| Worthington | 5,000 kw. | July, 1957 |

When the first turbine went into service, Fairfield Power plant management decided upon a turbine lubricant they felt would be dependable—NONPAREIL Turbine Oil. Standard Oil, they found, would give them concrete evidence of the oil's dependability. They received a certificate guaranteeing that, for the life of the turbine, the acidity of the oil would never exceed 0.15 mg. KOH/g. Indeed, through the years the oil has remained at a much lower acidity level, usually in the order of 0.06 mg. KOH/g. Periodic analysis of the oil in Standard's Whiting laboratory confirms that the oil is performing according to guarantee.

The kind of service Fairfield Municipal Light & Power gets from NONPAREIL Turbine Oil comes about this way: NONPAREIL is the subject of special refining techniques and handling. A special crude is used as a base stock. All sludge-forming compounds are removed. An oxidation inhibitor which permanently controls acidity is added. No sweetening or resting of NONPAREIL Turbine Oil is required at any time.

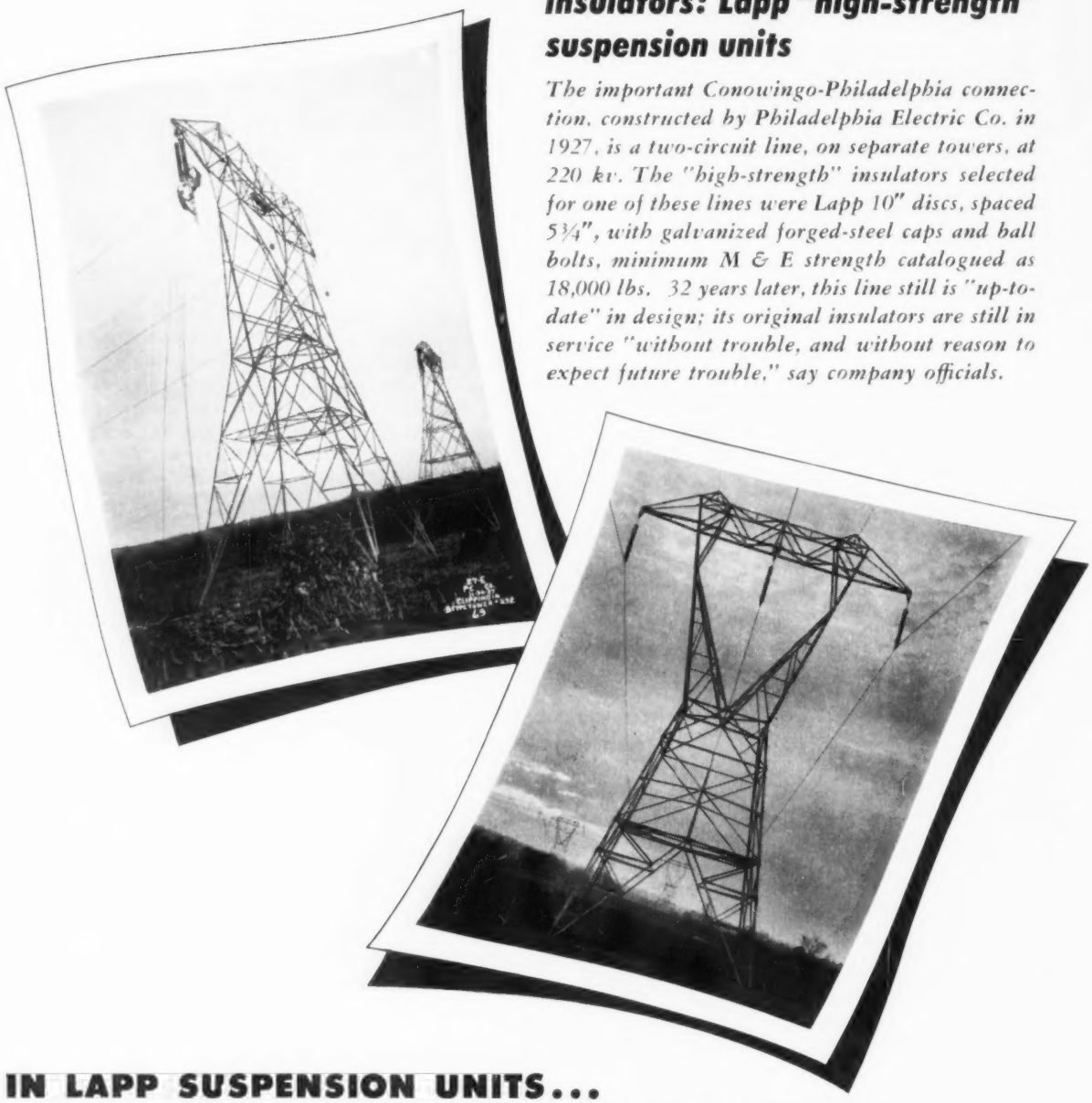
Men with experience in turbine lubrication can give you more facts about NONPAREIL Turbine Oil. Call your nearby Standard Oil office in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

*You expect more from* **STANDARD** *and you get it!*

Standard's Charlie Brown, here with Easton, supervised installation of NONPAREIL Turbine Oil in Worthington turbine. His experience and training qualify him for such work. Charlie received science training and graduated from Eastern Illinois State College. He has nine years' service with Standard Oil and has completed Standard's Sales Engineering School.

## *In 1927, Philadelphia Electric's "EHV" was 220 kv...its choice of insulators: Lapp "high-strength" suspension units*

*The important Conowingo-Philadelphia connection, constructed by Philadelphia Electric Co. in 1927, is a two-circuit line, on separate towers, at 220 kv. The "high-strength" insulators selected for one of these lines were Lapp 10" discs, spaced 5¾", with galvanized forged-steel caps and ball bolts, minimum M & E strength catalogued as 18,000 lbs. 32 years later, this line still is "up-to-date" in design; its original insulators are still in service "without trouble, and without reason to expect future trouble," say company officials.*



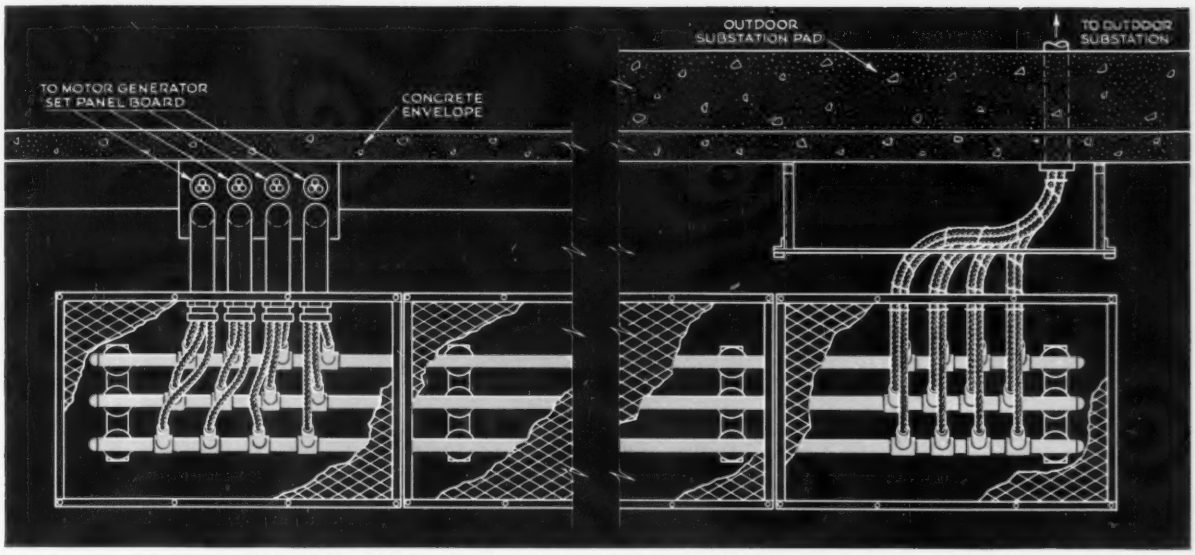
## IN LAPP SUSPENSION UNITS... HIGH STRENGTH AND LONG LIFE GO TOGETHER

Selection of suitable insulators poses no such serious problem to designers of today's and tomorrow's EHV transmission systems as had to be faced by their predecessors of a generation ago. The principle that high strength and long life can both be built into a suspension unit, vigorously challenged through the 1920's, was established. Lapp units, built for such installations as shown above, met strength requirements; their service records prove their reliability and durability.

Lapp 25,000-lb. units are offered today for your EHV and other high-mechanical-loading requirements, both in conventional 10" discs and fog-types. Their proved design, their uniformity of mechanical and electrical characteristics and their service records merit your confidence in their selection and specification for lines of highest operating security and trouble-free long life.

**Lapp**

Lapp Insulator Co., Inc., Le Roy, New York.




Side elevation of secondary bus system, using round tubular copper bus conductors, 2½" S.P.S., in unused plant tunnel. The run is approximately 275 feet long.

# Round copper tube bus carries more amperes per pound of copper—cuts installation costs

When a large eastern electrolytic refinery recently shifted to purchased electric power, it capitalized on the electrical and mechanical advantages of round tubular copper bus conductors to effect some economies.

Directly below the 10,000 kv-a outdoor substation was an unused coal conveyor tunnel that ran some 275 feet back to the former powerhouse. In this, the secondary bus system using 2.3-kv high-conductivity bus tube, 2½" S.P.S., was installed as shown in the drawings.

These round conductors, having an extremely low skin-effect ratio (1.01) can carry well over 300 amperes per pound of copper—compared with less than 275 amperes per pound for rectangular bus of the same cross-sectional area.

In addition to this material saving, round conductors in standard pipe sizes made possible installation savings through the use of stock-size supports, connectors, and other hardware.

Substantial savings are often possible through the use of a tubular bus with a low wall-thickness-to-diameter ratio. More complete information on tubular conductors is available in the Sixth Edition of The American Brass Company's Publication C-25. This 62-page booklet has a wealth of general information on the properties of copper conductors—plus convenient data for the most commonly used sizes of all types of rigid bus conductors.

**TECHNICAL SERVICES.** Anaconda specialists are available to help you in the solution of technical problems involving the use of Anaconda Bus Conductors. For such service, or for a copy of Publication C-25, see your nearby Anaconda representative. Or write: The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass, Ltd., New Toronto, Ontario.

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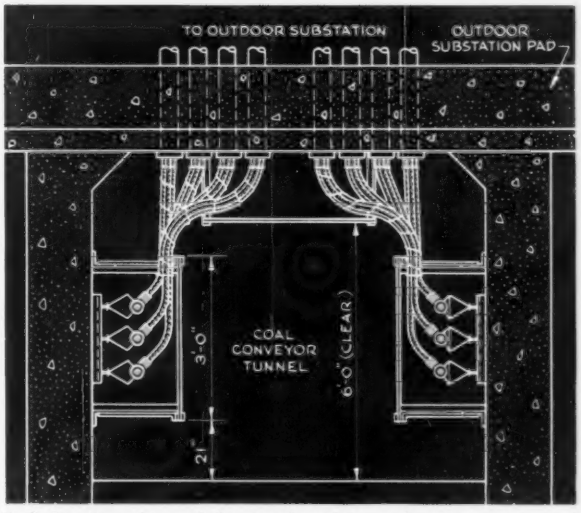


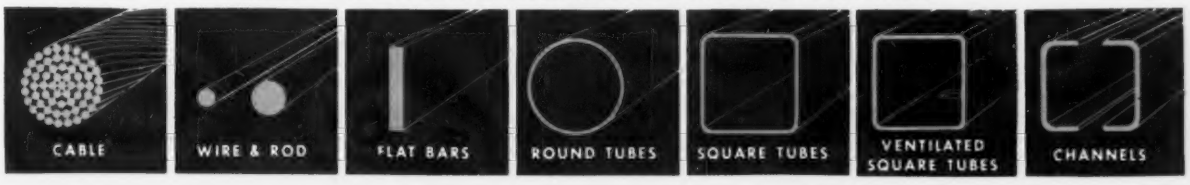

End elevation of tunnel showing how bus conductors are mounted on either wall, covered by a simple expanded metal enclosure.

**ANACONDA®**

**COPPER CONDUCTORS**

**Made by The American Brass Company**

**THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED**



*No "ifs," "ands," or "buts" . . .*

# full 600-amp subtransmission load

## *with S & C's Alduti Load Interrupter*

Here are two important reasons for full-load, full-voltage switching (as distinguished from loop sectionalizing where the voltage across the switch is low):

*First*—Emergency situations (wires down, etc.) demand quick action, hence dumping the load. There is no time to set up communications for complicated breaker and switch sequencing.

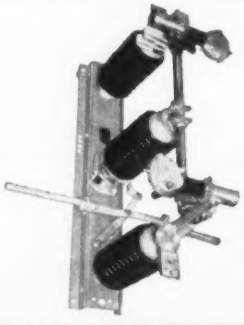
*Second*—There's always the possibility of an operator error or misunderstanding, with the result that a loaded circuit may be dumped inadvertently.

Under these circumstances, you will need *full* switching capability—with no limitation on the voltage across the device or on the load current.

The S & C Alduti Load Interrupter, with a record of 10 years of successful field operation, gives this kind of performance. It has had complete field tests under all circuit conditions, not simply line dropping or loop opening but at full load and at full voltage—600 amperes at 34.5 kv. Besides, this testing has been made extensive enough to provide published life ratings. And you get all this at the lowest price premium over bare disconnects.

Specify S & C Alduti Load Interrupters. For further information: S & C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S & C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

The S & C Alduti Load Interrupter (Double-Break style). Illustrated here is the 600-ampere 34.5 kv rating. Note the *two* interrupting units in series.



If you are considering switches at 23 kv and 34.5 kv, check this list to be sure you are getting:

1. Full 600-amp load switching capability without line breaker or feeder breaker openings. ☐
2. Positive interruption of even very heavy current in parallel or loop circuits. ☐
3. Sure interruption of associated magnetizing and charging currents —cable charging included. ☐
4. A fully tested interrupting device, tested not only for full ratings but also for operational life. ☐
5. Maximum attainable safety to equipment or personnel if device is inadvertently opened. ☐
6. A device which uses a maintenance-free interrupting medium. ☐
7. A device with contacts which can be left for long periods of time without maintenance. ☐
8. A device that can be mounted in any position; vertical, upright, or inverted. ☐
9. A device which has a long period of field use and operational success behind it. ☐
10. A device which operates without external arc. ☐

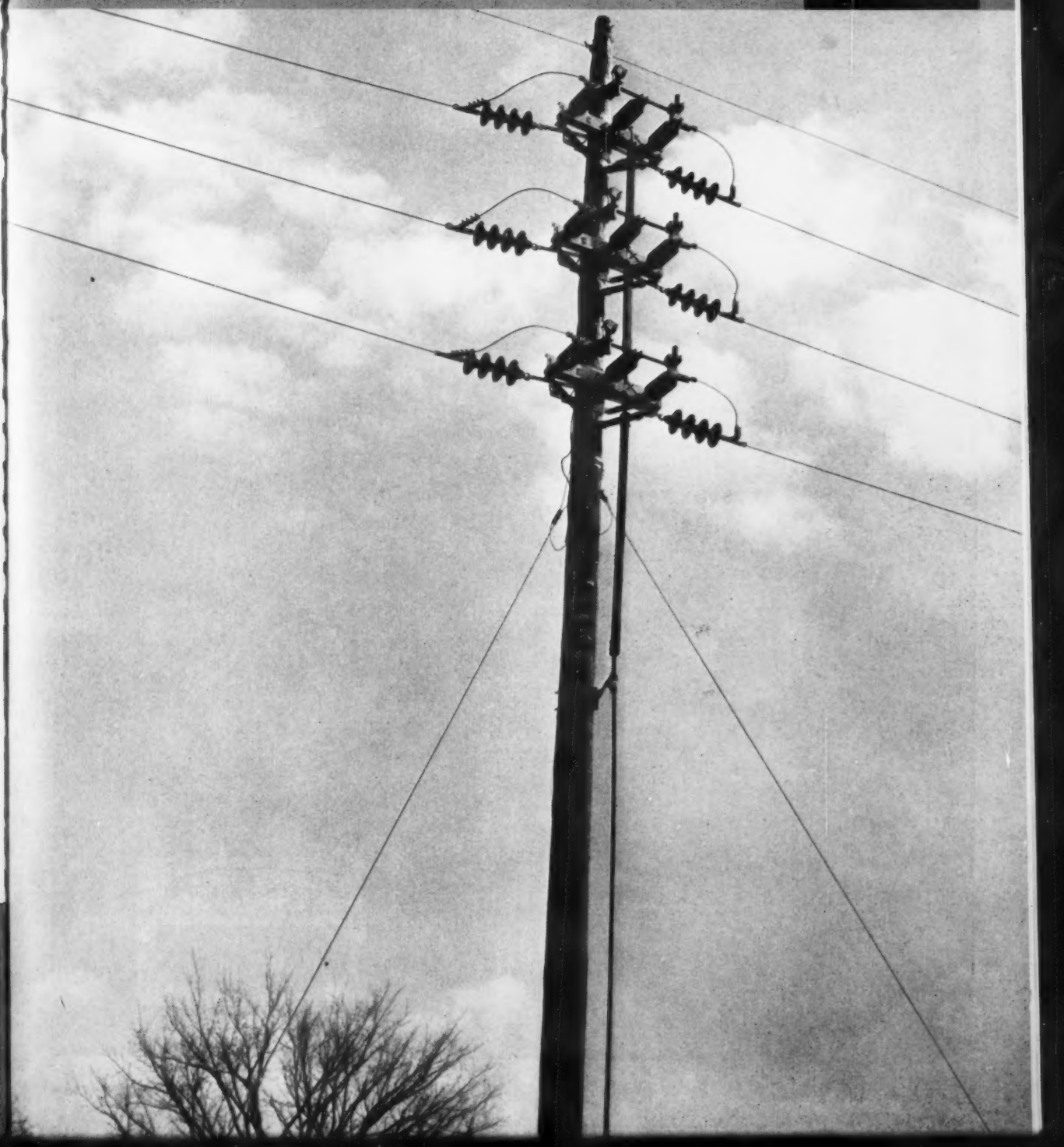
Disconnects • Cutouts • LOADBUSTER® Load Interrupters • Metalclad Switchgear Fuse Links • Power Fuses

S&C LOAD INTERRUPTERS

*Specialists in High-Voltage Circuit Interruption Since 1910*

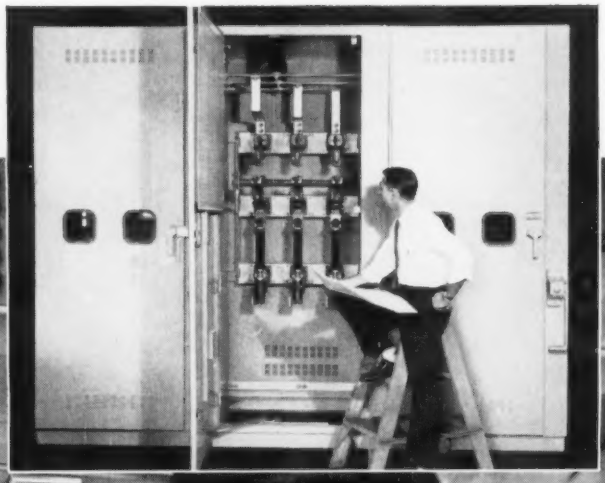
# switching at full line voltage

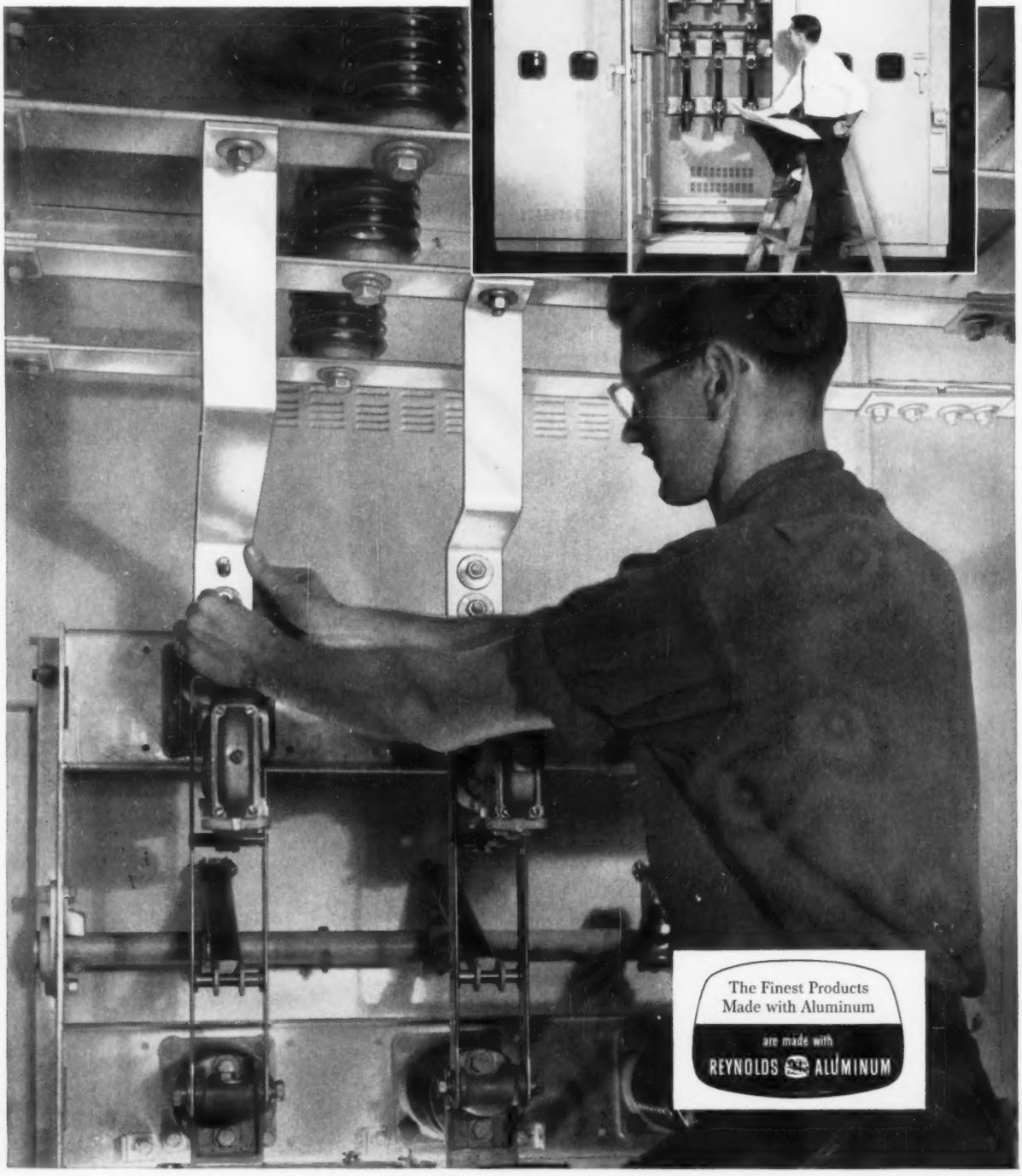
*...and at the lowest premium over disconnects*



# S&C metalclad switchgear

Typical S & C High Voltage Metalclad Switchgear Unit. Assembler, below, installs section of Reynolds Silver Plated Aluminum Bus.





The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

# production runs smoother with REYNOLDS ALUMINUM Silver Plated Bus Bar

## Design and Appearance Improved . . . Forming, Sawing, Punching Simplified

S & C Electric Company, Chicago, Illinois, finds Reynolds Silver Plated Aluminum Bus Bar ends bothersome and costly production problems . . . and provides extra plus benefits too!

First, Reynolds Silver Plated Bus Bar needs no preparation, painting or masking before fabrication. The bar is simply taken from stock and put right into production.

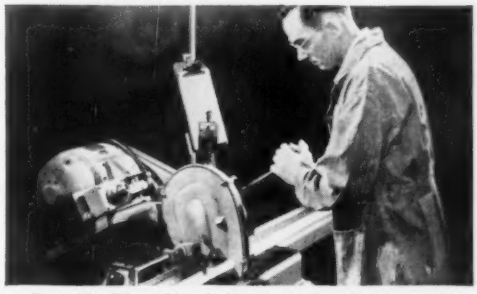
Second, aluminum is exceptionally easy to fabricate. And, the silver plating . . . designed and quality controlled by Reynolds . . . never peels or chips around the work edges in punching, forming or sawing.

Reynolds Silver Plated Bus Bar contributes to the attractive appearance of S & C metalclad switchgear available for both indoor and outdoor high voltage applications. And, S & C obtained all these advantages without changing from previous enclosure size standards.

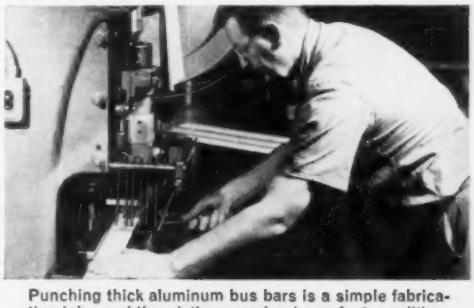
*Lower in cost than equivalent copper bar, Reynolds Silver Plated Aluminum Bus Bar requires no prior preparations, provides simple, inexpensive and reliable connections. It's the first commercially available plated aluminum bar with established quality standards!* It meets *all* electrical code requirements.

These are just a few of the reasons why aluminum is being used more and more in modern electrical distribution systems.

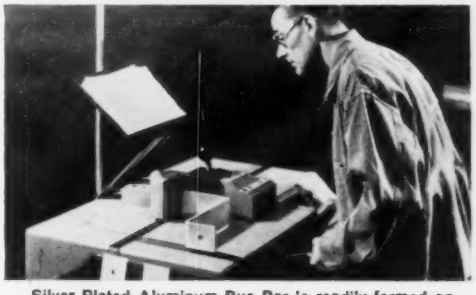
For details and availability data, write today for the new brochure, "Reynolds Silver Plated Aluminum Bus Conductors", *Reynolds Metals Company, P. O. Box 2346-EL, Richmond 18, Virginia.* For assistance from Reynolds Engineering Service call your nearest Reynolds office or write to the above address.



Reynolds Silver Plated Aluminum Bus Bar is easily sawed, yet the plating never peels or chips.



Punching thick aluminum bus bars is a simple fabrication job—and the plating remains in perfect condition.



Silver Plated Aluminum Bus Bar is readily formed on existing equipment.

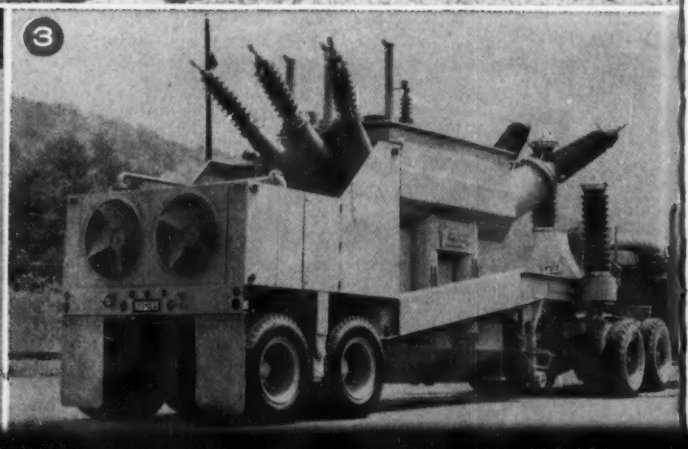
# REYNOLDS ALUMINUM

*Watch Reynolds new TV shows*—"WALT DISNEY PRESENTS" *and* "ALL-STAR GOLF"—*every week on* ABC-TV.

## New York State Electric and Gas Corp. reports..

1

2



3

# MOBILE SUBSTATIONS

# "AN ESSENTIAL TOOL" IN OPERATION OF ELECTRIC DISTRIBUTION SYSTEMS

***Advantages include:***

***IMPROVED SERVICE TO CUSTOMERS***
***LOWER MAINTENANCE COSTS***
***SAFER WORKING CONDITIONS***

An official of the New York State Electric and Gas Corporation makes the following report on his company's use of mobile substations:

"The New York State Electric and Gas Corporation has found that mobile substations are an essential tool in the operation of electric distribution systems. Modern factory-assembled mobile substations such as the 5000-kva Pennsylvania Transformer 'Transmobile' substation (shown here in service) are used to insure the least possible inconvenience to customers when service continuity is threatened by reason of the following:

1. testing and maintenance of substation transformers;

2. replacement of transformer banks to provide increased capacity or higher voltage operation;

3. alterations and/or additions to substation structures for purposes of rehabilitation or enlargement of facilities.

"In addition, there is, of course, the obvious usefulness of mobile substations for restoring service following failure of a permanent substation, and for serving temporary loads or new loads prior to the completion of permanent facilities.

"Experience has shown that the use of mobile substations for planned maintenance of equipment and alterations to substation structures gives direct benefits of lower labor costs and safe working conditions. By transferring the load to a mobile unit when work is scheduled on a permanent substation, this work can proceed during regular hours and under safe working conditions. In turn, the resulting improved working conditions will enable the crew to operate more efficiently. If a mobile substation is used where the construction of temporary facilities would otherwise have been necessary, the man-hours of labor which would have gone into the installation and removal of such temporary facilities can be used more productively."

To provide all the advantages outlined in this report by New York State Electric and Gas Corporation, a mobile substation must combine maximum substation versatility with maximum mobility and installation ease. Pennsylvania Transformer—as shown by the representative units pictured on these pages—has the experience needed to meet individual substation requirements while custom-designing to satisfy highway weight and clearance limitations.

Pennsylvania's experienced engineers will gladly work with you in determining the most efficient mobile substations for your system. Contact Pennsylvania Transformer Division, McGraw-Edison Company, P. O. Box 330, Canonsburg, Pennsylvania.

McGRAW EDISON

## PENNSYLVANIA POWER TRANSFORMERS

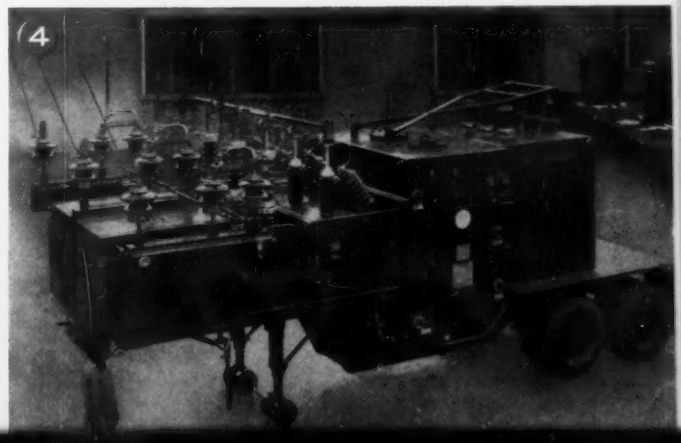
PENNSYLVANIA TRANSFORMERS

1. At Elmira, N. Y., a Pennsylvania Transmobile Substation replaces a 5000-kva bank during installation of a new 10,000-kva unit. New York State Electric and Gas Corporation reports that mobile substations reduce costs of maintenance and alterations.

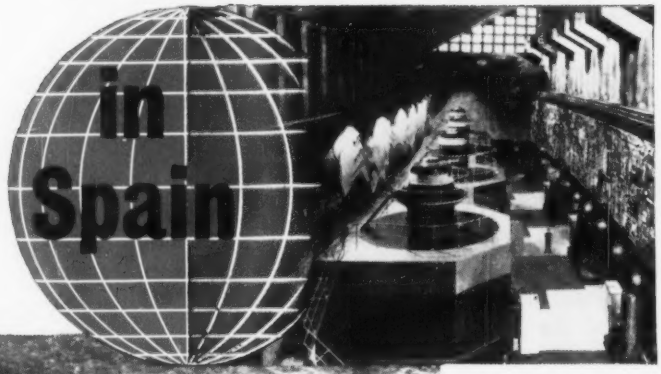
2. The same 5000-kva unit, "ready to roll."
High voltage: 34400Δ volts.
Low voltage: 2520/4360Y/2520x5040/8320Y/5040x7560/13090Y/7560 volts.
Tertiary voltage: 12600 volts.

3. 15000-kva mobile autotransformer (138-69 kv) now serving a Southwestern utility. Innovations include rotatable bushings to reduce set-up time.

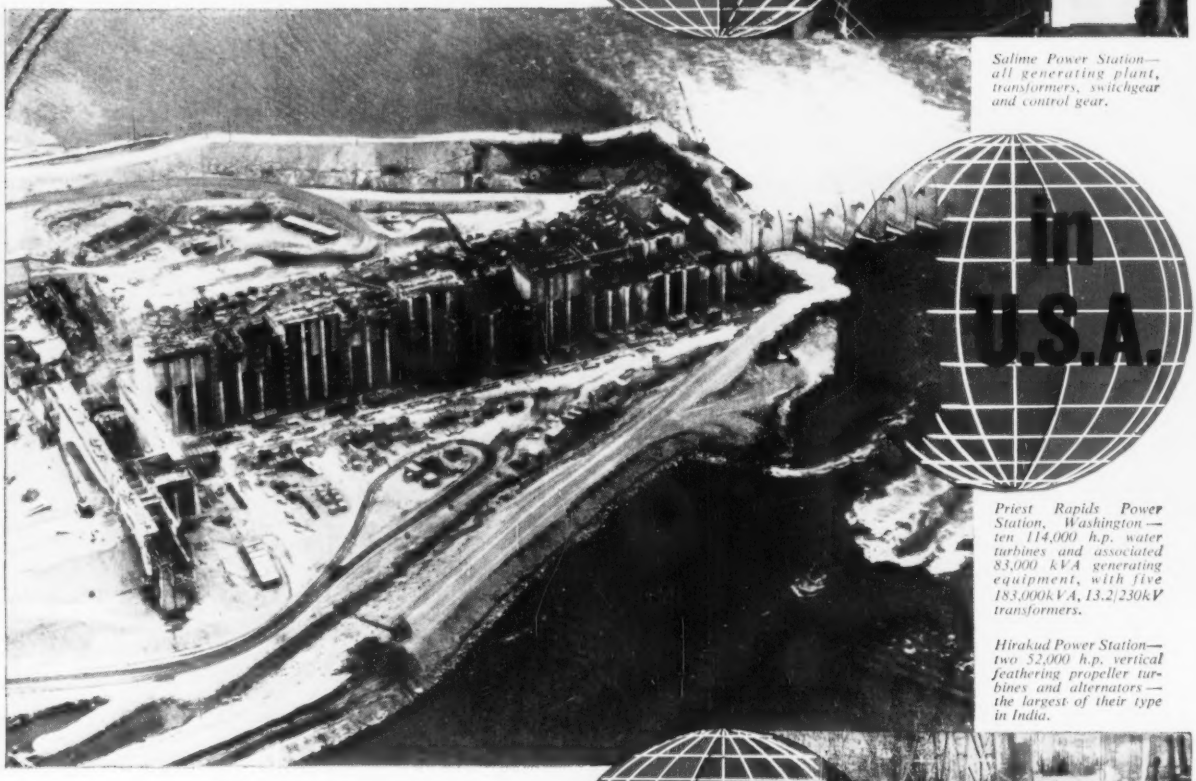
4. 3750-kva Pennsylvania Transmobile Substation custom-designed for an Eastern utility.
High voltage: 25700x51400Δ volts.
Low voltage: 2520/4360Y/2520x5040/8720Y/5040x7560/13090Y/7560 volts.



# The world over...

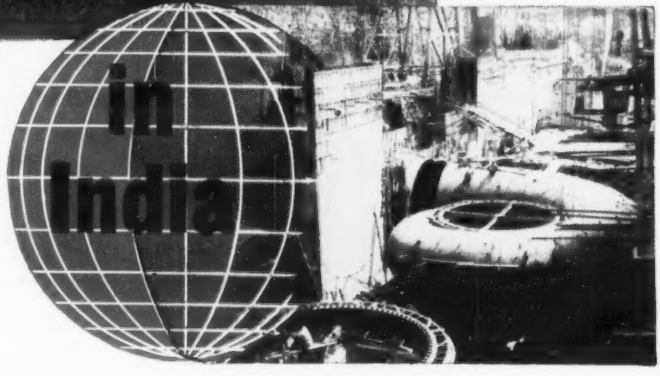



*Salime Power Station—all generating plant, transformers, switchgear and control gear.*




*Priest Rapids Power Station, Washington — ten 114,000 h.p. water turbines and associated 83,000 kVA generating equipment, with five 183,000kVA, 13.2/230kV transformers.*

*Hirakud Power Station—two 52,000 h.p. vertical feathering propeller turbines and alternators — the largest of their type in India.*




'ENGLISH ELECTRIC' water turbines and generators have been installed throughout the world. At three major schemes in the United States, 'ENGLISH ELECTRIC' hydro-electric equipment will be adding some 1,630,000 h.p. to America's power potential.

'ENGLISH ELECTRIC' products cover all aspects of the generation, transmission and utilization of electric power. Service facilities are available through three large Canadian plants. Contracts have been completed and are in course of manufacture for many other major American power projects.

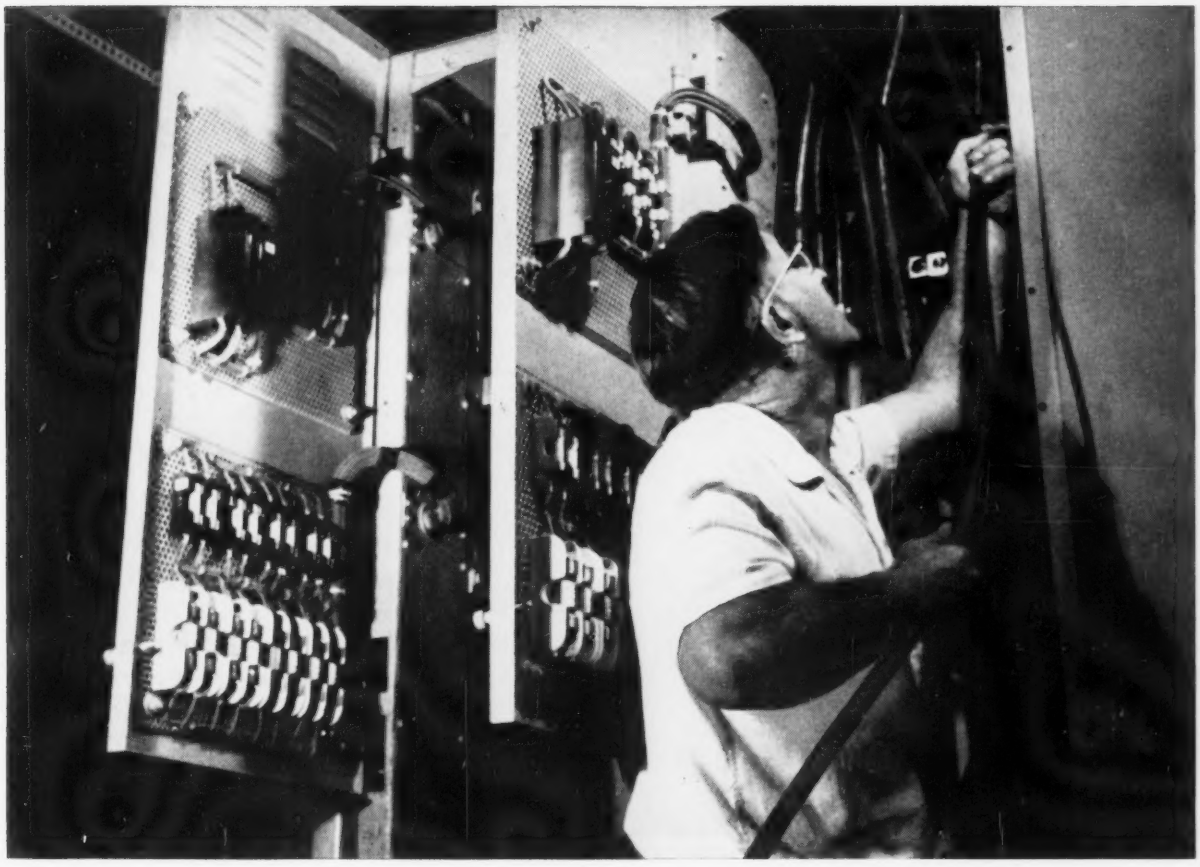
# 'ENGLISH ELECTRIC'

**Agents for Washington, Oregon, Montana, Idaho, Wyoming, Nebraska, California, Arizona, Utah, Nevada and the Alaska territory: James I. Metcalf & Co. Inc., 701 United Pacific Building, Seattle 4, Washington. Branch offices in San Francisco, Los Angeles, Portland, Phoenix. Agents for Georgia, Alabama, Tennessee, South Carolina, Florida and Kentucky: Osgood & Associates, Inc., 988 Spring St., N.W., P.O. Box 7383, Station C, Atlanta 9, Ga. Agents for Louisiana and Mississippi: Electron Equipment Co. Inc., 1050 Constance St., New Orleans, 13, La. Agents for Texas, Oklahoma, Arkansas and New Mexico: Peabody Bros., 2903 St. Louis St. at Oakland, Dallas 26, Texas. Branch offices in Houston and Tulsa.**

*Enquiries for territories not covered by Agents should be directed to:*

ENGLISH ELECTRIC EXPORT & TRADING CO. LTD., 750 THIRD AVENUE, NEW YORK 17, N.Y. Telephone: MURRAY HILL 7-0303

OC.US.2



# When you must pack a lot into a small space . . . specify Rome's "CT-2" control cable

These cables are intended for installation in underground conduits or ducts, directly in the earth, or open air.

**Conductors:** Conductors conform to ASTM Specification B-8.

**Insulation:** Insulation conforms to IPCEA Appendix P.

**Color Coding:** All conductors shall be color-coded in accordance with IPCEA recommendations.

**Assembly:** For three conductors or more, the insulated color-coded conductor shall be twisted with jute fillers when necessary to make round, and a suitable tape shall be applied over the assembled core. Two-conductor cable shall be flat.

**Over-all Sheath:** An over-all sheath of Rome Synthinol* shall be applied over the tape core.

Here's a way to speed up the job of making complex control-panel connections in tight quarters. Install cable that meets your *budget*, *quality*, and *space* requirements.

You'll find that just such a cable is Rome's "CT-2" control cable. Its smaller diameter will fit into your most compact panel arrangements. It's lightweight, too, and easy to pull through conduit. And it represents good quality at moderate cost.

### Your choice of cable sizes

This low-surface-friction cable has an all-thermoplastic construction featuring $\frac{3}{64}$" Rolene insulation (polyethylene) plus an over-all sheath of Rome Synthinol (polyvinyl chloride).* It's available as a standard construction with one to 12 conductors in No. 9 and No. 12 AWG sizes.

**Insulation:** Sure and dependable terminations are possible because Rolene strips cleanly. This smooth, positive-stripping polyethylene lets you consistently make an efficient installation.

**Sheath:** Rome Synthinol is a thermoplastic (PVC) compound that offers high resistance to oils, most acids, alkalis, grease, gasoline, weathering and flame.

Use Rome's "CT-2" control cable for your next job where space is at a premium and fast, efficient installation is mandatory.

Find out how Rome's control cable can fit your installation picture. Contact your nearest Rome Cable representative—or write to Department 852, Rome Cable Corporation, Rome, N. Y.

*Alternate sheaths of Rolene (polyethylene) or Roseal (flame-resistant polyethylene) are also available.

**ROME CABLE**

**CORPORATION**

**NEW UTILITY STATIONS, C-E EQUIPPED**

Includes only new stations on new sites placed in operation since JANUARY 1, 1950.

LAKE CATHERINE
HUTCHISON
YATES
DUNKIRK
TITUS
LEE
CONTRA COSTA
HAWTHORN
NINEMILE POINT
EDGE MOOR
PALATKA
JOHNSONVILLE
DANSKAMMER
BECKJORD
HIGHGROVE
PLANT X
BLACK DOG
ALBANY
JOPPA
MERAMEC
PORTSMOUTH
LAKE CREEK
ETIWANDA
AURORA
HENNEPIN
EASTLAKE
OAK CREEK
SUWANNEE RIVER
URQUHART
KINGSTON
SANDOW
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BARRY
NORTH OMAHA
WILMINGTON
CARBON
SAGUARO
MORRO BAY
VERMILION
JOHN SEVIER
COLLIN
MILLIKEN
GALLATIN
BARRETT
MITCHELL
SAN BERNARDINO
YORKTOWN
GULF COAST
TUCSON
PORT WENTWORTH
W. A. PARISH
ALLEN
MONTROSE
McMEEKIN

**LEWIS and CLARK**

# New Lewis and Clark

The Montana-Dakota Utilities Co. recently put into operation the initial unit at its new Lewis and Clark Station.

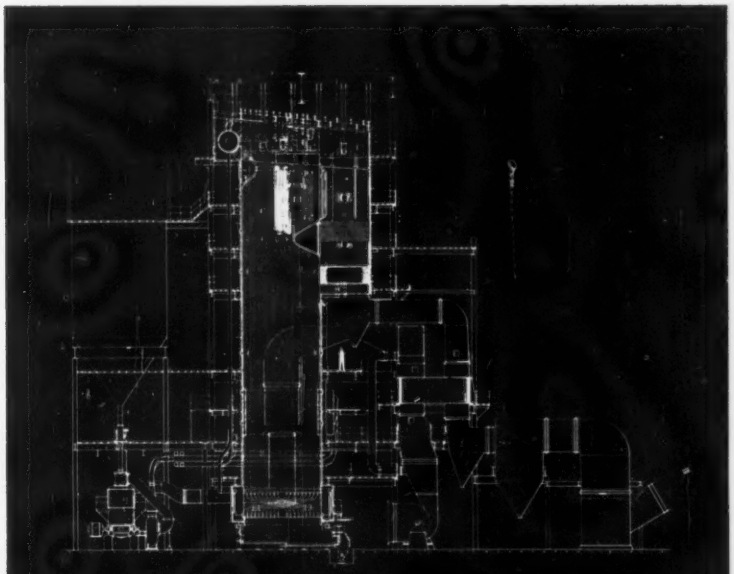
Located two miles south of Sidney, Montana, on the bank of the Yellowstone River—where the historic Lewis and Clark exploration party journeyed—this is the largest and most modern generating station of the system. Its turbine-generator, rated at 44,000 kw, increases MDU's new generating capability by nearly 50 per cent. The station was designed and constructed by Ebasco Services, Inc.

This new station, the first in which MDU has used pulverized fuel, is presently the largest "raw" lignite plant in the United States and Canada. The lignite is delivered by rail directly from a new strip mine approximately 24 miles away.

Furnishing steam for the Lewis and Clark Station is a Combustion Engineering Steam Generating Unit capable of delivering 425,000 pounds of steam per hour. A cross-sectional elevation and brief description of this boiler appear on the opposite page.

Station

# NOW IN SERVICE



The C-E Unit shown above is now in service at the Lewis and Clark Station. It is a radiant-type boiler with a plain-tube, skin-cased furnace. The superheater is of the multi-stage type, with secondary and finishing surface at the furnace exit and primary surface in the rear pass. Economizer surface is located below the rear superheater surface, and a regenerative air heater follows the economizer. The unit is designed to burn lignite and/or natural gas, using bowl mills and tilting, tangential burners. It supplies steam at 1350 psig and 955 F.

## COMBUSTION ENGINEERING

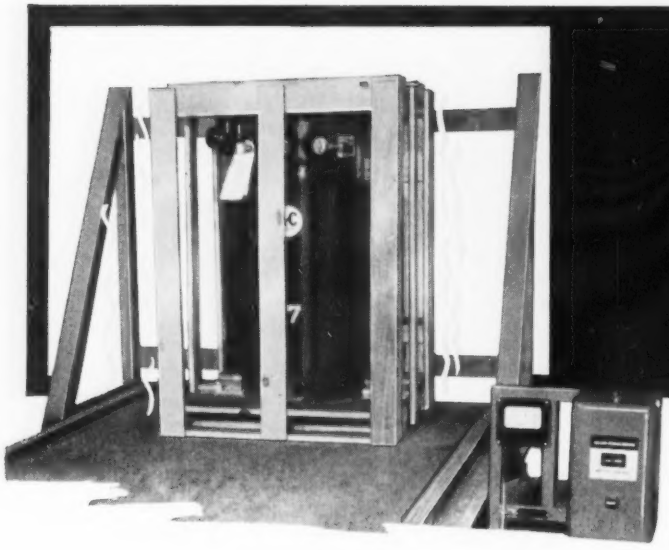
C-E

C-201

**Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.**

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

**There's a good reason WHY...**



Allis-Chalmers

# RESEARCHES CRATE DESIGN

## Distribution transformers arrive in FACTORY CONDITION

EVERY conceivable type of transportation rigor is simulated—the Gaynes Package Tester, shown above, duplicates freight car and truck conditions of speed, irregularities of track and road, action of truck springs. The Conbur Incline, a shock-imparting machine, subjects crated transformers to various impacts sustained in actual shipment — crates are designed to provide maximum protection. A seal certifying approval by the National Safe Transit Committee appears on every Allis-Chalmers crate — further assurance that transformers are ready to give you years of dependable service.

This is only one of the many good reasons why Allis-Chalmers distribution transformers assure outstanding performance for many years. For *all* the good reasons, call your A-C man, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

**ALLIS-CHALMERS**

A-5719

# Editorial Comment

FEBRUARY 16, 1959

## "Do It Yourself"—The Time Is Ripe

The time is ripe for convincing at least a few more Americans of average intelligence that there's more to be lost than gained today, by abdicating individual, local responsibility to the federal government.

For this reason the words of Elmer Lindseth in a recent and forthright attack on today's lethargic "let George Do it" attitude bear repeating here:

"We—you and I, and our fellow Americans—have abdicated to government the responsibility for controlling almost one-third of this country's total income. If we think we can throw away that much responsibility without losing some of our freedom, we are sadly deluding ourselves."

In answer to the recurring question facing all of use today "What specifically can we do about it—you and I?" the Cleveland utility executive proposed a "do it yourself" program to protect our freedoms. In it he called on all of us to:

- Inform ourselves—and be sure we keep informed
- Tell others—everybody who will listen
- Educate the younger generation—today's young people need our help
- Take active part in self-government—support a political party
- Register to vote—and *then* be sure to vote
- Make our views known to our elected representatives—we must tell them what we want them to do
- Don't use government as a crutch ourselves

This final point deserves underscoring in Lindseth's own words:

"Let's make sure that we are never guilty ourselves of using government as a crutch. . . If government favoritism is wrong when bestowed on some other business, its equally wrong when it favors *our* business."

## To Keep Political Posters Off Poles

A one-man campaign to keep political posters off utility poles met with both success and recognition in Northern Virginia during the campaigns last fall.

Local newspapers reported that the old practice of tacking up posters had vanished and gave credit to Charles H. Russell, representative for a number of small firms who sell safety equipment to utilities and contractors.

Russell, who is widely known in Washington circles, lists three substantial reasons for his one-man campaign:

- Nails, tacks, and splinters are a hazard to utility linemen.
- Old posters are a blow to civic pride.
- They cause confusion on the part of motorists.

Russell started off by writing a letter to all candidates in northern Virginia asking them to refrain from posting cards on power poles. All but one of the candidates agreed to stop. Russell then contacted the State Highway Department, and state officials ordered that posters be removed because they violated the state code.

Arlington County revised its ordinances to place restrictions on pole posting—requiring candidates to get permission from the utilities.

These three actions turned the trick. Beside showing what one man can do, they may guide utilities who have trouble with posters in election years.

# AIEE Told to 'Define Engineer's Role in C

**Killian, Eisenhower science aide, tells winter general meeting of need to raise engineering to the level of other professions, arts. Foote is nominated for AIEE president**

Members attending the winter general meeting of the American Institute of Electrical Engineers in New York were told to "more clearly define your role in society" by Dr James R. Killian, chairman of President Eisenhower's Scientific Advisory Committee, and chairman of Massachusetts Institute of Technology Corp.

Specifically, Killian urged the engineers to:

- Accurately depict for the general public what the engineer does. This will help raise the level of the profession to that of other professions and the arts.

### Audacity, Imagination Urged

- Employ engineering with the audacity and imagination to "achieve a world in which people everywhere may lead free and abundant lives."
- Make engineering recognized as "a creative activity that augments man's dignity and understanding and that affords him intellectual adventure of the highest order."
- Improve engineering education to meet the rising requirements imposed upon the profession by a rapidly changing world. He called for more graduate education for engineers in new engineering sciences and those "other subjects formerly considered abstruse that now have solid engineering applications."

The AIEE general session also heard AIEE President L. F. Hickernell (Anaconda Wire & Cable Co) call for more research—and research that is cross-referenced to save needless time and expense. "Year after year, millions of dollars are wasted by duplication and repetition of research. At the same time, libraries are being filled to overflowing. . . We are being smothered in our own product." The Institute president wants a central agency to index and code scientific and engineering literature.

President Hickernell pointed out that AIEE long ago (1894) recognized the need for such an agency, and noted that, "At long last, something is being done about this situation." He referred to the National Education Act of 1958 which directs the National Science Foundation to establish a Science Information Service which shall:

**1.** Provide indexing, abstracting, translating, and other services leading to a more effective dissemination of scientific information; and

**2.** Undertake programs to develop new or improved products, including mechanized systems, for making scientific information available.

Viewing the need for more cooperative research, Hickernell drove home his principal point thus: "In the electrical industry, basic research (as differentiated from applied research and development) is carried out by a relatively few large manufacturing companies and utilities, commercial and endowed laboratories, government agencies and universities. A considerable portion of university research is financed by foundations or the government. The time is fast running out when small segments of the industry can survive solely by applied research and development. . . On this basis, the only possibility I see for small industry's future in the free-enterprise system lies in the organization of cooperative basic research laboratories by various branches of the industry.

"This personal observation is made without investigation of legality. However, if cooperative research laboratories of this type are illegal, consideration should be given to changing the laws, in the interest of maintaining technological supremacy for the welfare of our nation."

### Hickernell's Successor Nominated

Another highpoint of the general session: The nomination of J. H. Foote for president of AIEE for the 1959-60 term, to succeed Hickernell. Foote, formerly president of Commonwealth Associates, has been on the AIEE board for six years. He is profiled on the opposite page.

Other nominations are as follows:

**For Vice Presidents—**

D. L. Greene, Gilbert Associates Inc; John W. Davis, Southern Bell T&T; Max H. Knight, U. S. Bureau of Reclamation; Dr Rene Du-

**JOHN FRITZ MEDAL** is awarded to Dr M. J. Kelly, left, Bell Telephone Labs, by A. C. Monteith, Westinghouse. Joint society award marks advances in science and technology

**EDUCATION AWARD** is presented to Dr J. F. Calvert, center, by AIEE President Hickernell, left. At right is Dr G. Farman-Farmaian, winner of Alfred Noble Prize Paper

# n Our Society'

puis, Quebec Hydro-Electric Commission; and F. C. Bacon, Gamewell Co.

**For Directors—**

S. O. M. Osthagen, Allis-Chalmers Mfg Co; E. I. Green, Bell Telephone Laboratories; and Hendley Blackmon, Westinghouse Electric Corp.

Incumbent treasurer C. H. Linder of General Electric Co received the nomination for treasurer again.

### Calvert Gets Education Medal

Dr. J. F. Calvert of the University of Pittsburgh received the AIEE Medal in Electrical Engineering Education for 1958. Dr Calvert was cited for "his distinguished service as a teacher of electrical engineering" and for "the high esteem in which his contributions are held by his fellow members of AIEE." President Hickernell made the award.

Calvert, in accepting the medal, called for "a new dimension" in engineering education—one in which the engineer would consider the social and cultural implications of his task, as well as the technological. He also asked for an expanded program of engineer-training for foreign students as a means of helping to offset Russia's exportation of engineers and technicians.

### Kelly Lauded for Leadership

Dr M. J. Kelly, board chairman of Bell Telephone Laboratories, received the John Fritz Medal, presented jointly by AIEE, the American Society of Civil Engineers, the American Institute of Mining, Metallurgical and Petroleum Engineers, the American Institute of Mechanical Engineers for "his achievements in electronics, leadership in a great industrial research laboratory and contributions to the defense of the country through science and technology."

Of the two other top engineering awards at the general session went posthumously to a noted American inventor and the other to a young Iranian PhD. The late Dr Charles F. Kettering won the Edison Medal for 1958, and Dr Ghaffar Farman-Farmaian received the Alfred Noble Prize Paper Award. Dr Kettering was cited "for invention, research and development in the broad fields of education, energy and power resulting in service to all mankind." Farman-Farmaian's paper on finite pulsed feedback systems was judged the best among papers written by members of sponsoring societies.

Among the other awards:

First place in the Power Division went to utilitymen L. H. Fink and J. J. Smerke of Philadelphia Electric Co for their paper titled, "Control of Thermal Environment of Buried Cable Systems—Part II." Second prize in the power division went to three Westinghouse Engineers—W. K. Sonnemen, C. L. Wagner, and G. D. Rockefeller—for their paper, "Magnetizing Inrush Phenomena in Transformer Banks."

AIEE also awarded a rare honorary membership to Dr Luigi Emanueli of Milan, Italy.

## Profile of a Nominee

**JAMES HAROLD FOOTE** is a Life Member of the American Institute of Electrical Engineers who last week in New York was nominated as its president for the 1959-60 term. A soft-spoken, mild mannered man, and an engineer to the bone, he was born to and has spent his entire life in the electrical industry. "My father and uncle were builders in Jackson (Mich.) who put together the systems that eventually became the Consumers Power Company. I came along in 1891, picked up my B.S. in civil engineering from Michigan State in 1914, and have been in the business ever since." He is director of engineering of Commonwealth Services.

Asked about his plans for AIEE, Foote cautioned that the Institute is a continuing body, with programs developed and carried out over the years. "Don't look for abrupt changes. I'd like to go ahead with those things that 'Hick' (Hickernell) has been working on . . . and do as good a job as he has been doing." For the long haul, Foote feels AIEE must offer more to its younger members, and ". . . instill in them a sense of obligation to the profession and to others."

The Footes (Mrs Foote is the former Marie Dinius; she married "J. H." in 1915) have a daughter and a son who is an engineer. He, in turn, has a son at Cornell studying—you guessed it—engineering! For recreation, Foote spends most of his off time at his retreat in the north Michigan woods. "I love wild, challenging country, not to hunt or fish, but just to observe."

# Fight Predicted on 'Giant' Power-Grid

**Senate resolution on studying transmission interconnections traces back to Leland Olds, staunch federal power backer**

The biggest public-private power fight in Congress in many years may grow out of a proposed Senate investigation of the nation's power transmission systems.

Sens James Murray (D-Mont.), Richard Neuberger (D-Ore.), and John Carroll (D-Colo.) have recommended a $300,000 study—probably taking a couple of years—into the "electric power supply situation of the U. S. and to recommend legislation to assure development and organization of bulk power supply. . ."

The hand of Leland Olds, former Federal Power commission chairman, can be seen in the proposed investigation. Olds has long advocated a nation-wide, interconnected power grid system—under federal control and operation—and Murray's study could come up with such a recommendation.

### Emphasis on Western States

Murray, in proposing the study, called for a "giant power grid" for the country—particularly in the western states—to produce the "greatest efficiency and economy" in power production. The study would look specifically into power links between Bonneville Power Administration, Missouri River Basin Projects and the Central Valley or Pacific Gas & Electric systems in California. Such interties could connect steam plants fueled by Missouri lignite with Columbia River hydro plants, an advocate of the study glowingly pointed out.

Murray criticized the existing power transmission situation, and called for the study to change it. "This nation cannot afford the present haphazard approach to the development of giant power grids," he pointed out.

He called for a "a study of power needs of the nation by areas; of the most appropriate geographic units to be interconnected so each could have the most dependable, low-cost supplies of thermal and hydro generating capacity and feasible transmission facilities. There needs to be a study of whether existing laws and regulations are impeding desirable interconnection and joint operations of private companies, or of private and public systems. . . It is my hope that hearings on the desirability of such a study will give us not only a very clear picture of the scope of the problem, but also the extent to which other committees of the Senate are involved and should participate in the final study."

Murray added, "there are savings up to 50% in the cost per kwhr of capacity in building (giant generating) plants, and further savings in fuel costs in giant, scientifically controlled boilers. Transmission over increasingly long distances have become possible."

Olds, reportedly pushing hard for the study, has long advocated a giant federal power system—backbone transmission lines with big federal plants to supply them—to sell power to municipal, cooperative and other agencies. In 1953, Olds called for "establishment by Congress of a 'Federal Giant Power Commission' to plan, finance, construct and operate large inter-regional wholesale power supply grids interconnecting federal hydro-electric systems."

### Resolution Seen as Wedge

Although Murray's resolution (S. Res. 71) calls only for a "comprehensive survey," private utility spokesmen see it as a new wedge into the power industry by federal power advocates.

Basic problems are how public and private transmission systems would be tied together: Would private or public systems be given exclusive rights or subsidies to build new backbone transmission lines, or would mixed, public-private organizations be established to operate them? A possible adjunct would be whether the FPC should be directed to license such major transmission lines as common carriers.

Murray's resolution has been referred to the Senate Interior Committee, of which he is chairman. One of the Interior subcommittees is expected to give the resolution—to set up the study—a favorable vote in one or two months. The full committee then would have to approve the study and send its recommendation—plus an appeal for funds—to the Senate floor for final approval.

Advocates of the Murray resolution have noted that the FPC, since 1953, has recommended compulsory interconnections between private utilities "duly found appropriate or in the public interest" by the FPC. However, the commission has cooled off in its desire for such legislation, which would require an amendment to the Federal Power Act, and it probably will not make such a recommendation in 1960.

Meanwhile, a bill to require sale of "excess capacity" in private interstate transmission lines to other requesting power systems has been introduced in the House.

Introduced by Rep Quentin Bur-

## TVA Contract Scored

TVA approval of a Britian firm's bid for a 500-Mw steam turbine generator—the first ever purchased abroad by the U. S. government—was criticized last week by Westinghouse and General Electric.

The TVA action "could establish a dangerous policy for the future," Westinghouse said. U. S. defense will suffer "by making us dependent on a foreign land for maintenance and repair of the largest generating unit in the TVA system," the firm said.

GE's W. S. Ginn, turbine division vp and general manager, called for curtailment of governmental agencies buying foreign built turbine generator units, also on security grounds. The company will protest the contract, he said.

Successful bidder for the machine is C. A. Parsons & Co, Ltd, on an evaluated bid of $13,140,700. Westinghouse's evaluated bid was $19,-

## Proposal

dick (D-N.D.), the bill would compel owners of private interstate power lines (33 kv and higher) to sell such "excess capacity" to other requesting systems on "fair and reasonable" terms, as authorized by the FPC.

"Excess capacity" would be defined as "that part of the capacity of any electric transmission facilities which is not required by the owner thereof to render adequate service to customers of such owner." Presumably, the "excess" would be above peak load requirements.

FPC would be required to regulate these lines as common carriers, establishing terms on which requests and wheeling contracts would be made.

Where federal lines are involved, Burdick's bill would give priority to preference customers.

Burdick introduced the bill (HR-3142) in response to complaints from North Dakota co-ops that they were unable to get adequate power deliveries, while transmission lines there weren't operating at capacity.

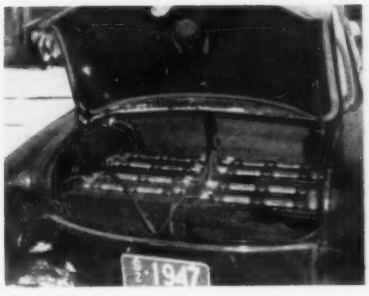
## ed by Westinghouse, GE

453,725; GE's, $19,673,780. TVA said the Parsons contract lowered estimates for the Colbert Steam Plant project from $80 million to about $75 million. Power revenues will pay for the initial cost, the agency said. If its bond-financing bill passes Congress, financing of the unit will be reviewed, TVA said.

Both Westinghouse and GE underscored the impact of the contract on U. S. employment at a time when heavy electrical apparatus plants are curtailing employment. "This order represents 1,080,000 man-hours of work which will be lost," or enough work "for 700 people for a full year," Westinghouse noted, adding "It will cost this country about $3.6 million in lost tax revenues."

The U. S. firms attributed the spread between Parson's bid and their's to average English wage rates that are only 37% of U. S. rates.

## Cleveland Firm Expands Truck Output, Takes a Close Look at Car Potential



Cleveland Vehicle Co, a small firm of 23 employees, two years ago threw a winch line onto the potential of small electric trucks. Today, the Ohio company has a big head start in the U. S. in that field and is bidding for a share of what may become a sizeable market for autos.

Cleveland Vehicle has delivered 50 of its delivery trucks to customers throughout the state, says Pres Walter Thomas. Recent improvements in the lead-acid batteries used for the trucks indicate that economies can be pushed below the present charging cost of about 1¢ per mi.

Successful testing of a new battery, a product of Exide (Electric Storage Battery Co) research, promises less weight per watt hour. This would boost the truck's payload above the present 3,000 lb, or increase its 90-mi cruising radius by reducing truck weight 500 lb.

Cleveland Vehicle plans to go into production June 1 on an electric car. A nation-wide distribution system for the car is being organized and Thomas says he hopes to have details on this completed by the June 1 date. Promotion plans and production figures are indefinite now. The company is concentrating on component parts details, including a built-in charger which could be plugged in to a 115-v, 15-amp outlet to recharge the 44-cell, lead-acid type Exide battery.

Utilities have expressed interest in the car, Thomas says, but he's not in the order taking stages yet. He estimates the car's price at between $2,300 and $2,500, and

promises 50% reduction of gas-driven models' operating costs.

Cleveland Vehicle is participating in a joint research effort that will aid the firm's car production debut. Along with five others, CV is studying the problems and economics of operating a converted Rambler. American Motors Corp, one of the participants, donated the auto; Electric Storage Battery provided the batteries, and Atlantic City Electric Co, Detroit Edison Co, and Maust Coal & Coke Co have donated funds for the project.

The conversion job has a top speed of 40 mph and a 43.3-mi range. It has a series wound traction motor powered by an 84-v 160-amp-hr Exide deisel battery.

## Nuclear Fuel Cost Halved, EEI Task Force Estimates

Three large-scale U. S. nuclear plants coming on the line in the early Sixties will have fuel costs ranging from 3½ to 7-mills per kwhr—about half the fuel cost at Shippingport. This estimate, based on cost of fuel and not total power cost, was released recently by Edison Electric Institute's Technical Appraisal Task Force on Nuclear Power.

The group's survey report dealt with the water-cooled reactor plants of Consolidated Edison Co of New York (Indian Point, 275-Mw), Commonwealth Edison Co (Dresden, 180-Mw), and Yankee Atomic Electric Co. (Rowe, Mass., 134-Mw).

A fourth plant—Power Reactor Development Co's more experimental Enrico Fermi Station—will have fuel costs somewhat higher than the preceding three.

Shippingport, jointly owned by Duquesne Light Co and the Atomic Energy Commission, has paid about 33 mills per kwhr for fuel on the first core, the report said. It observes, despite the acknowledged uncertainties involved in estimates, that continuing reactor development and accumulation of data will help lower fuel costs of these and subsequent plants.

The EEI report is called, "Survey of Initial Fuel Costs of Large U. S. Power Stations."

# Permanent Federal Role

**Spending on handling, disposal facilities totals $200 million; Sporn feels shift to private responsibility should come by '79**

The high costs of radioactive waste disposal must be considered in any discussion of target dates for "economic" nuclear power. However, although private industry must ultimately take over responsibility for the disposal task, the federal government is in the regulatory picture to stay.

These were chief conclusions arising from recent hearings by the Joint Congressional Committee on Atomic Energy into problems of radioactive waste disposal.

Rep Chet Holifield (D-Calif.), subcommittee chairman who ran the hearings, says potential hazards from radioactive wastes of the peacetime atomic power industry are greater than fallout from atomic bomb tests.

Another witness, Dr Abel Wolman of John Hopkins University, points out, "The supervision and control of some of these wastes must be viewed, not from the standpoint of temporary expediency, but from the necessity of guaranteed supervision and control, in some instances for hundreds of years."

Wolman and other experts pointed out that present waste management by the Atomic Energy Commission follows two general lines: First, high-level radioactive wastes, the more dangerous variety, are concentrated and contained; ie, stored but not permanently disposed of. Secondly, low and intermediate level radioactive wastes are diluted and dispersed to nature in the ocean, running streams and atmosphere.

### Problem Ignored, Says Wolman

Wolman, a member of the AEC's advisory committee on reactor safeguards, observes that government assumption of responsibility for waste disposal has led many "industrialists" to ignore the problem and its impact on reactor economics. He points out that some $200-mil-

# Companies Fail on Information

Electric power companies, solidly situated from record-breaking performances in nearly all departments and under way now on vigorous plans for the future, still are plagued by the inroads of public power. And despite all their accomplishments, the investor-owned companies are failing in the job of informing U. S. citizens of the threat government encroachment poses.

This was the view of E. M. Naughton, Utah Power & Light Co president, who stressed the dereliction of duty at the second annual Power Progress Dinner Feb. 5 for newspaper, TV and trade press representatives in New York City. The session was sponsored by the Electric Companies Public Information Program.

"We have not succeeded in convincing other American industry that nationalization of the electric industry will ultimately lead to nationalization of other industry, that nationalization of other industry will lead to government controls and economic influence which can have a vital effect on the economy of other American business," said Naughton.

Despite the efforts of PIP, the Electric Companies Advertising Program, Edison Electric Institute, and individual companies, the industry "is not doing the job," he said.

One example of "the government competition front," he said, was the Internal Revenue Service ruling that forbade income tax deductions for advertising arguing against government's role in the power business.

Although Sen Estes Kefauver (D-Tenn.) and others have called the ads political propaganda, they have not refuted the truth of the statements on tax advantages and other

# Seen on A-Plant Waste Disposal

lion already has been invested in handling and disposal facilities.

"The selection of sites for nuclear energy facilities is closely related to waste handling and disposal problems," he adds.

A. L. Bethel, testifying for the Bettis division of Westinghouse Electric Corp, described waste disposal practices at Shippingport.

Waste disposal operations at the plant cost an average of $9,300 per month, but Bethel says it's too early to tell if these costs are typical.

One utility industry spokesman was Philip Sporn, president of American Electric Power Co. He made three basic points:

- Until industry takes responsibility for the "whole operation," including processing and fabrication of fuel elements, there is the danger utility men will favor conventional over nuclear-fueled plants because all cost factors are known in the former.

Ultimately, therefore, the government must be eliminated from even "benevolent" operations and restricted to a regulatory role. Sporn believes this transition to private responsibility should take place within 15 to 20 years.

- Most fuel reprocessing should be done by a separate fuel processing industry. The rest should be done on site by the power producer.
- Ultimately, responsibility for regulatory supervision should be placed in state or local hands, following such federal guide-lines as are deemed necessary. Where more than one state is involved, interstate compacts are "an ideal instrument."

### Prefers Co-op Arrangement

"I recognize," says Sporn, "that state and local agencies may need assistance from the federal government . . . but my hope is that this can be accomplished by cooperative arrangements between the AEC and other federal and state agencies, through temporary loans of personnel, grant-in-aid measures and the like," instead of through permanent federal regulation.

Sporn found support among such experts as Wolman, who offered the view that any attempt to leave regulation of waste disposal entirely in "centralized" federal hands ultimately would "collapse of its own weight."

However, there is considerable skepticism among members of the joint committee that the federal government ever can afford to relax its regulatory grip very much in view of the long-range nature of the problem.

T. G. LeClair, manager of research and development for Commonwealth Edison Co, helped put the waste disposal problem in perspective with his description of disposal plans being made for the Dresden plant, now under construction.

"If the entire electrical output of this country (were) obtained from heterogeneous reactor plants . . . the total amount of nuclear fuel throughout would have been less than one-half train load," he said. "Even so, the volume of waste from the nuclear fuel would have been less than one hundredth of 1% as much as from fossil fuels," Le Clair added.

# Job: Naughton

aspects of government power, Naughton said.

S. L. Drumm, West Penn Power Co president, described some of the advances in electrical living that we'll have by 1979.

An industrial worker, for example, will have 29,000 kwhr a year at his disposal then vs 10,800 kwhr today. Average residential use will be about 10,000 kwhr; "It could be considerably more than that, as the average for some companies is crowding that figure today," Drumm said. For 75-million households predicted for '79, the industry will supply something like 750-billion kwhr.

Among other developments that will be altering U. S. living patterns in the near future will be the electric automobile. They'll "be ideal for city and suburban use . . . cost less to operate than existing cars, will be simple and easy to drive, and maintenance will be negligible," he said. Storage battery improvements may permit the electric's use for cross-country travel, he said.

**POWER PROGRESS PARTICIPANTS,** left to right, Lindseth, Drumm and Naughton

The industry will produce about 2¾-trillion kwhr and have some 600-million kw of generating capacity 20 years from now, he predicted. The amount of new capital that all this will require will total well over $150 billion of today's dollars.

Elmer L. Lindseth, head of Cleveland Electric Illuminating Co, spoke on the industry's role in nuclear power. He likened the federal assistance on atomic reactors to the Air Force's research and development on jet engines now in use by commercial airlines. This was accomplished, he said, without nationalization of airplane equipment manufacturers or of the airlines.

# 230-Kv Transmission Expansion

## Duke Power's power system development involves more higher-voltage transmission

**F. W. BEYER**, Planning Engineer, Duke Power Co, Charlotte, N. C.

Expansion of Duke Power Co's 230-kv transmission system appears inevitable in any long-range plan for developing power supply. Studies, which pushed planned system capacity beyond 4,500 Mw, showed that the most economic pattern for the period immediately after 1961 involves development of at least another high-capacity, centrally located generating plant. This should precede the opening of a new fringe area site, requiring considerable extension of the 230-kv system.

Extension of the 230-kv system would have benefits, including these:

**1.** Land rights for major plant sites, transmission rights-of-way, and the tie station locations would be acquired early, and these acquisitions would become increasingly important as population density grows.

**2.** Trends in generator design and cost point to larger unit sizes. Expansion of the 230-kv transmission system, favoring large generators, conforms with anticipated technological advances.

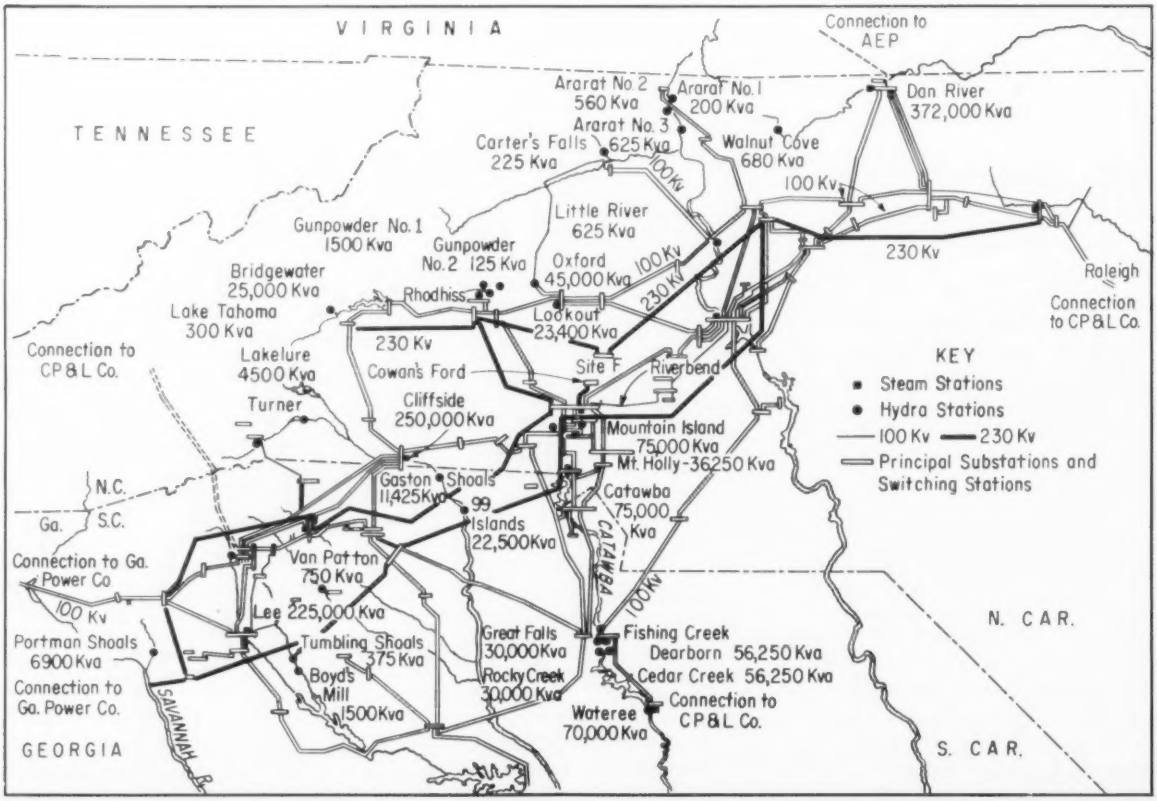
**3.** It is conducive to the orderly development of the system. By opening a high-capacity plant and extending the 230-kv transmission system, generator capacity additions can be programmed independently of area requirements. Construction may be advanced or suspended to meet changing conditions. Delay in opening new generating sites until additional 230-kv transmission is in service would allow development of sites for system rather than local area supply.

**4.** Extension of the 230-kv transmission system would closely integrate system generating facilities, resulting in more effective use of system reserve capacity, total required and spinning, and enhancing economic loading of generators.

**5.** Development of a strong 230-kv grid would allow easy access to all areas of the system when significant savings are indicated for future minefield generating plants.

**6.** Extended 230 kv not only strengthens coverage of the service area but also provides access to neighboring companies for high-capacity interconnections which are becoming increasingly desirable.

Plans have considered not only steam-electric plants, but facilities for peak-load service also. Installed Catawba River hydro capacity is firm for peaking under




**SITE F** will accommodate a new steam plant as part of plan to take advantage of the storage reservoir created by the development of Cowan's Ford. The reservoir will supply water for cooling. Ultimate capacity will be 1,200 Mw

# Inevitable

minimum annual stream flow. At the present rate of load growth, an additional 350-Mw of hydro capacity on the river will be firm and economical under the 1965 load curve. It is planned to develop this capacity by constructing a new hydro plant, Cowan's Ford, between the Mountain Island and Lookout Shoals plants, about seven miles upstream from the Riverbend Steam Plant.

The new plant will have a head of 112 ft, which in conjunction with existing plants will have harnessed about 85% of the total 1,050-ft fall of the Catawba River on its 217-mile course through the Duke Power area. It is anticipated that the first three units, representing 262.5 Mw of the total 350-Mw design capacity, will be in service by mid-1963.

Thereafter, the preferred plan will take advantage of the storage reservoir created by the Cowan's Ford development for cooling water for a new steam plant. After development of this site, the ultimate capacity of which is estimated to be 1,200 Mw, and completion of Cowan's Ford to its 250-Mw design capability, the 230-kv transmission system will have been strengthened to where new large capacity fringe-area plants will be desirable.

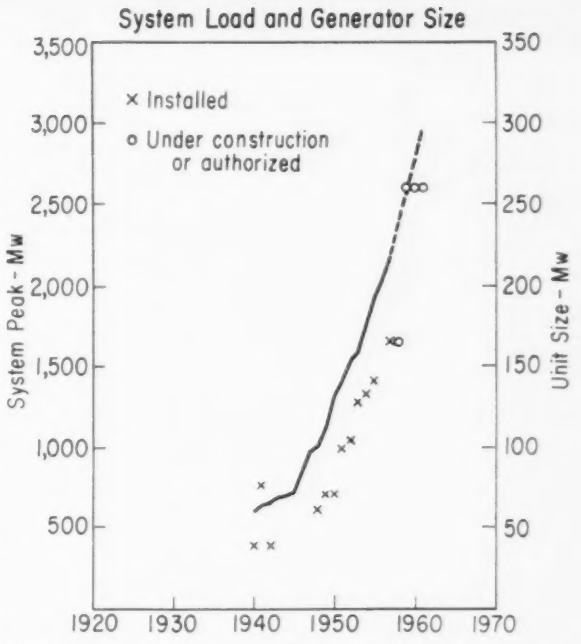
Reserves for the Duke system are estimated from detailed study of known and contingent factors. Reserve requirements were estimated in terms of peak load at 10% immediately following World War II. This figure today is 15%, as the number and size of generating units have increased and the seasonal load variation has been diminished by the increasing summer load. The system has 25 steam-electric generating units of which 12 are the reheat type. The reheat units range in size from 95,000 to 165,000 kw, and each unit is opened for routine inspection every third year. Outage lasts up to six weeks when major repairs are not needed.

### More Reserve Seen for 1961

Non-reheat units, whose capability ranges from 33,000 to 76,000 kw, are serviced every fourth year, requiring about four weeks' outage when major repairs are not necessary. As state laws require annual inspection of all steam boilers, reheat boilers are shut down for seven days and non-reheat boilers for four days, when major repairs are not necessary.

Every effort is made to service two or more units simultaneously, taking advantage of spring and autumn seasonal load variation. Yet the number of units has about reached the point where scheduled servicing on a 12-month basis is necessary. A 15% reserve requirement represents about 385,000 kw for the 1959 load estimate. Such reserve permits earmarking up to 165,000 kw of capacity for the servicing program, emergency outage of like capacity, and affords a 55,000-kw margin for unexpected load growth.

Two units of 260 Mw and possibly one of 282 Mw net capability will be in service by 1961, when the reserve margin will have increased to about 18% of the estimated peak load. While reserve in percentage of peak load has little meaning unless related to the maximum unit size, total units and shape of the load curve, consideration of these factors indicates the larger margin, including the capacity of interconnections, is prudent.



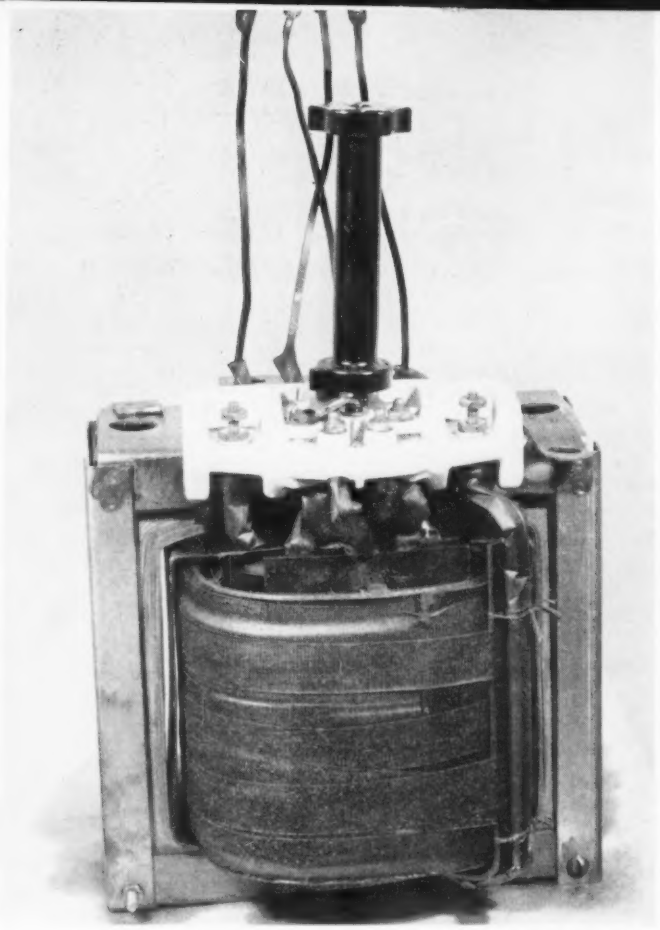

**SIZE** of new units has averaged about 7% of system peak but, according to plans, will jump to about 10% in 1959

Historically, the size of new units has averaged about 7% of the system peak load, but will jump to about 10% this year.

At the end of the war, the maximum unit size was 76 Mw, and steam pressures and temperature were up to 1,250 lb and 950F, respectively. Between 1948 and 1953, the size of units went up to 128 Mw, the steam pressure to 1,800 lb, and the steam temperature to 1,000F, and the reheat cycle was adopted. With these developments the five-year gain in performance was about 13%.

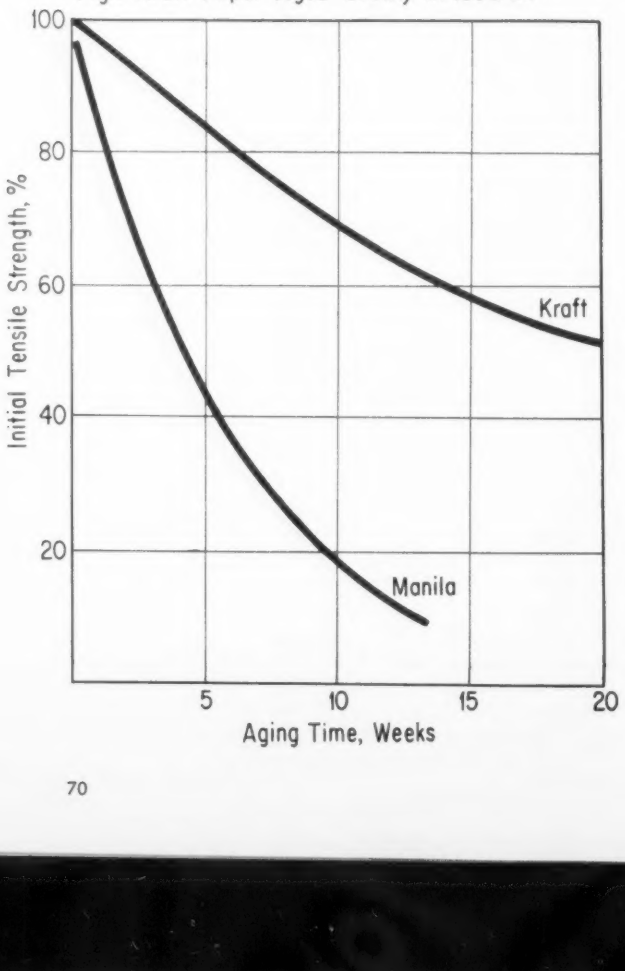
Since 1953, the size of units, including some under construction, has more than doubled to 260 Mw net, steam pressure has gone to 2,400 lb, and the main steam temperature to 1,050F. In spite of these developments, the gain in performance for the 1957 Allen units—165 Mw net capability—is only 2% better than for the 1953 units. For the 260 Mw 1959 and 1960 units, with a design performance of 8,900 Btu/net kwhr, the gain is only 3.9%. Within the subcritical pressure range and existing economic temperature limit of 1,050F, generation is approaching a condition where even minor additional gains are extremely hard to attain.

Up to the present the gain in efficiency was the important equalizing factor in keeping power production costs reasonably in line. But because of the definite slowdown in possible gains in efficiency for the immediate future, the largest possible unit and plant sizes with their lower installation and operating costs are of increasing importance in the continuing effort to maintain stable consumer rates in the face of inflationary economic pressures.



**MODERN TRANSFORMER** discloses little deterioration after five years on life test at a hot-spot temperature of 105 C

Fig.1-Kraft Paper Ages Slowly in 135C Oil




# Distribution T

## Modern transformers perform consistently better than guides indicate; revision of guides to realistic levels is indicated by experience

**M. F. BEAVERS**, Advance Design Engineer, Distribution Transformer Dept, General Electric Co, Pittsfield, Mass.

Improvements in distribution transformers have seemingly outmoded ASA guides for transformer loading. Modern transformers, better designed and using better materials than earlier types, consistently perform better than guide specifications indicate. Revision of the guides to provide a more realistic performance level is indicated.

The superior aging characteristics of well-dried kraft paper over the manila paper formerly used and the standard use of 50% of initial tensile strength as a cutoff point for useful life account for some of the variance between expectations and experience.

In 1940, an AIEE subcommittee issued a preliminary document entitled "Guides for Operation of Transformers and Regulators." This guide, giving loading recommendations in excess of the nameplate rating when operating in 30C standard ambient conditions, was published in 1942 as ASA document C57.3. The theory is based on the so-called "8-degree" rule, developed by V. M. Montsinger in 1930. The rule states that the aging rate doubles for each 8C increase in temperature. Below 100C a smaller degree rule is customarily used.

Revisions made in 1948 and 1956 expanded the guides to cover a broader field of information. The revisions made the same load-time recommendations for normal life expectancy, but presented information on insulation aging which would permit estimation of the effects of loading on life. This information was based on the same data used in establishing load-time recommendations in 1940, because no better data were available. A considerable amount of study has since been given to the mechanism of insulation failure, and more is in progress.

Considerable evidence accumulated recently indicates that insulation deterioration is a function of the reciprocal of absolute temperature, and that no constant "degree rule" exists. The loading guide recommendations are based on rather meager data (mostly laboratory tests using mechanical strength as the criterion), but the guide has been used for 15 or 20 yr and the only complaint has been that it is too conservative. This is admitted in the guide, but it was felt to be the only practical method because of the variety of transformers and operating conditions.

Tests reported by Treanor and Raab in a 1950 AIEE paper show that several transformers ran for 15 yr at 105C hot-spot temperature and then withstood short-circuit tests, although later examination of the core and coils showed the coils to be in an extremely embrittled and blackened condition. The loading guide indicates that a transformer operating at 105C should last about one year.

# Transformers Surpass ASA Guides

Similar tests reported by Klingensmith in a 1956 AIEE paper show that a transformer operating at 115 C hot-spot temperature ran for 0.8 yr (cumulative time at 115C) and was still in operating condition. The loading guide indicates that the unit should last about 0.3 yr.

Both sets of tests were made on transformers of the semi-sealed and now obsolete type. Modern distribution transformers are more completely dried and sealed in the factory, thus prolonging insulation life. They also contain inhibited oil to assure extra-long oil life.

The bases upon which the ASA guides were established are not too clearly recorded. However, it is generally believed that the loss of life curves (Fig. 92-840 of ASA Appendix C57-92) were based on laboratory test-tube data, tempered by sound judgment reflecting operating experience.

The laboratory tests consisted essentially of paper samples placed in test tubes containing transformer oil. Tubes were heated, and a sample was periodically withdrawn and the paper subjected to mechanical strength tests. These tests provided an indication of the rate of degradation under test conditions. Because there was evidence that the dielectric strength of paper in oil does not change appreciably with deterioration, the life of insulation for oil-immersed transformers was generally based on mechanical strength rather than on dielectric strength.

### Data Based on Manila Paper

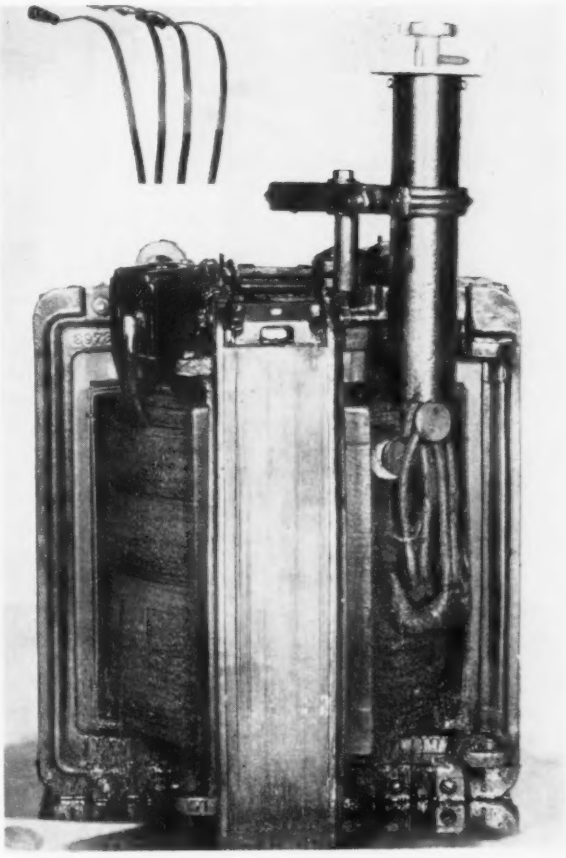
Most of the aging data are based upon tests on manila paper, which was a popular turn insulating material when the loading guide curves were prepared. Conductors in many distribution transformers are now insulated with film-type insulation and the layers are separated by thin sheets of kraft paper. Therefore, aging standards based on manila are of somewhat less value now in predicting transformer life. Aging data on the life of kraft paper would be much more appropriate.

Typical temperature-time curves for manila and kraft paper are shown in Fig 1. They illustrate the superior thermal endurance characteristics of kraft paper. Clark has shown, in a 1942 AIEE paper, that moisture has a marked effect on paper aging. Fig 2 shows that as moisture content is decreased below about 1% the relative life is considerably increased.

Knowing the initial strength of the paper, mechanical strength data are usually expressed in percent of initial strength. By making tests at several elevated temperatures, sufficient data were obtained to determine the time required to reduce the strength of the paper to an arbitrary level, such as 80%, 50% or 20% of initial strength.

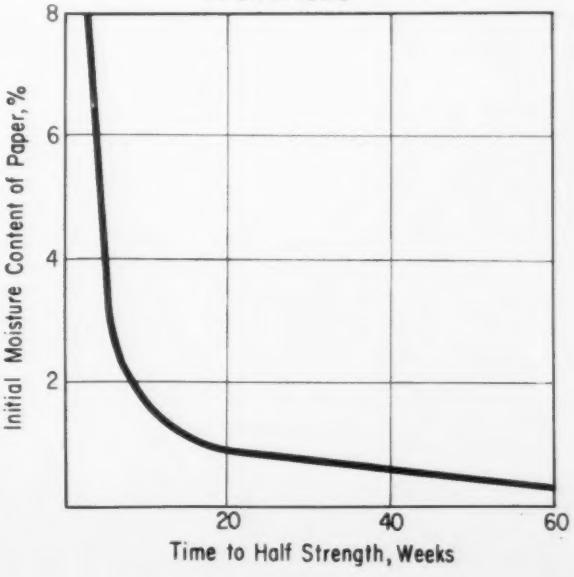
It is not clear from the literature which criteria level was used in establishing the loading guide but inferences were found which indicate that the loss of life curves are based on the life to 50% of the initial mechanical strength at various temperatures. If this is correct, it appears to be ultra-conservative, because

(*Continued on page* 108)



OLDER TRANSFORMER of same rating shows sludge deposit after approximately same life test (six years)

Fig.2-Moisture Affects Aging of Manila Paper in Oil at 100 C



# Carrier Links Plants With Four Voice Ch

R. L. **BRINTON,** General Superintendent of Communications, Pacific Gas & Electric Co, San Francisco, Cal.

Multi-channel power line carrier provides four voice channels between two large steam generating plants on the Pacific Gas & Electric Co system. There are two intermediate substations.

Communications requirements between the plants included immediate need for three through-voice circuits, with near-future need for another. Further, it was necessary that one of the three provide party-line service at the intermediate substations.

To meet these requirements, three methods were considered: Open wire telephone lines with carrier channels; microwave with sub-carrier channels; and the power line carrier channels. On the basis of first cost per circuit plus maintenance cost, and reliability, multi-channel power line carrier was selected. Because two 220-kv transmission lines connect the two steam plants, initial cost of power line carrier would be less than half that of other methods.

Early in the study, single-channel power line carrier was ruled out because of frequency spectrum limitations. The 220-kv lines already carry power line telephone carrier, telemetering, and relaying control circuits, restricting the remaining spectrum.

Older types of power line carrier needed about 20-kc bandwidth to get a single full duplex voice circuit. The newer types of single-channel equipment need only 12-15 kc. For the required four channels, this meant the over-all width must be 48-80 kc, depending upon type of equipment used. With the new four-channel carrier, it was possible to get four full duplex channels in a 36-kc bandwidth.

Party-line service at the intermediate stations normally would require the single-channel power line carrier to be operated back-to-back with a voice frequency interconnect. This presented difficulties not easily overcome, especially in maintenance of stable voice frequency levels. Using the four-channel carrier, intermediate station interconnection was made at carrier frequency between the two halves of the carrier repeater.

This required only one carrier channel terminal located at that point. To avoid "signal run-around" or "sing", the new four-channel repeater provided frequency translation, by which a repeater transmits both ways on the same frequency. This is similar to the "frogging" of telephone practice. By this practice, exactly the same frequency spectrum was used throughout between the steam plants, further conserving the system frequency spectrum.

The manufacturer of the carrier uses a system similar in many respects to telephone "J"-type carrier, with common amplifier for all four single-sideband channels and indi-

# Special Generator Supplies Power For Crews

When electrically operated power tools plus radio and floodlights for night work became too much for the regular line truck generator, Wisconsin Electric Power Co installed a special generator of 1,500 watts capacity. The generator runs off the truck engine. It operates at 3,600 rpm and generates at 120 volts with a 12½-amp capacity.

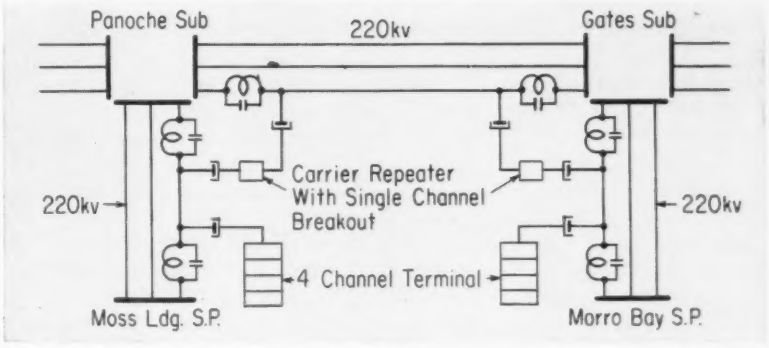
Control of the unit is by a switch which is mounted on the dash board of the truck. When the switch is turned on, an electric clutch is engaged, putting the generator in operation. The unit is 6¼ in. in diameter and 15¾ in. long and is installed under the hood.

# Channels

vidual channel regulation applied. This is coupled to one phase of a power line through directional filter and standard 0.001-0.003-mfd capacitor. The directional filter unit, with coupling capacitor and single-tuned wave trap, acts as a band-pass filter about 36-kc wide.

Each single-sideband voice channel has a 300-3,000-cps bandwidth and includes its own carrier-shift signaling facility, using 3,400-3,600-cps frequencies. Signal tones are used as pilots for individual channel regulators. Each channel terminal has a built-in compandor, which may be switched in or out of the circuit as required. The compandor will hold signal-to-noise ratio to at least 50-60 db, equal in quality to the best microwave and telephone carrier circuits. The signal-to-noise ratio is accomplished at nominal transmitting level of only 1 w per channel.

An entire terminal, including ac power supply panel and standby ac inverter, mounts in a standard 19-in. equipment rack only 7 ft high. This is no larger than that needed for a single-channel 10 or 25-w power line carrier cabinet. Fading is not a problem in this type of power line carrier. Dependability is expected to be equal to microwave and better than telephone line carrier.




**THROUGH-PATH** at carrier frequency allows intermediate station breakout. The carrier can be switched to an alternate power circuit (not shown)

To provide continuity in the carrier channel, a duplicate path is provided over a parallel 220-kv line, with identical coupling capacitors, wave traps and directional filters. A switch at each terminal enables the station operator to select either 220-kv circuit.

Facilities of the party-line channels at the intermediate substations have proved invaluable. This circuit provides a party line from the system load dispatcher to all four points. Because the dispatcher is not located along this system, extension to the dispatcher's office is provided by a second single-channel power line carrier.

Performance of the four-channel carrier indicates much lower capital costs and lower maintenance and operating costs than experience indicated for microwave or standard power line carrier systems.

# Extension Levers Improve Winch Control

**DONALD M. BURTON,** Driver-Groundman, Indiana & Michigan Electric Co, Muncie, Ind.

Detachable extensions made to fit over winch control levers on line trucks permit safer and easier winch operation. The extensions permit the driver to sit erect and devote full attention to the signalman, instead of reaching over in the awkward position otherwise required to operate winch levers.

Each extension lever consists of a 9-in. length of 1-in. pipe (to fit over winch control lever) welded to a 24-in. length of ½-in. rod. The rod is bent to the operator's convenience. A hole is drilled through both pipe and winch control lever and a steel pin inserted to give added stability. Pins can be removed and levers stored when the winch is not in use.

Operating ends of the levers are capped with bicycle grips. Total cost for two extension levers is under $5.

STANDARD LEVERS

EXTENSION LEVERS

# Change Standards to Reflect "A

## Re-rate transmission lines to reflect actual weather conditions instead of conservative national standard ratings

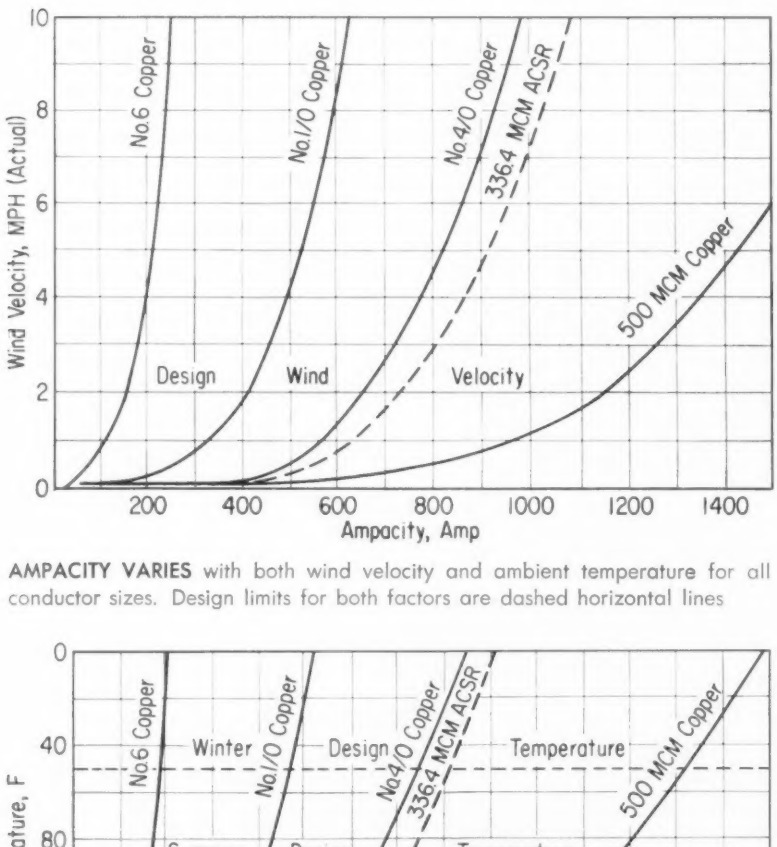
**LEON F. MURRAY**, Engineer, General Engineering Dept, Consumers Power Co, Jackson, Mich.

Studies of current carrying capacities in relation to existing conditions on a utility's system may result in appreciable savings in fixed plant investment. Standards should be based on existing conditions rather than using the ultra conservative national practices set up to meet extremes of a wider area.

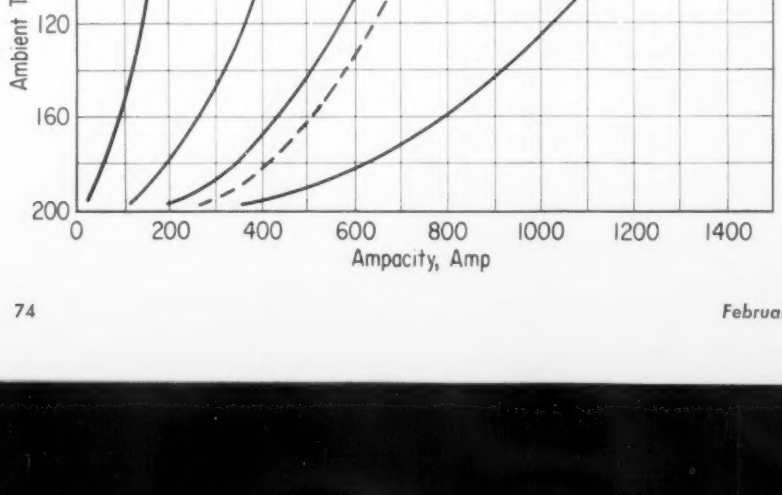
In the process of analyzing conditions and establishing acceptable conductor loading practices, Consumers Power Co adopted the term "Ampacity". Its meaning, which has in the past been applied to cable, is "current carrying capacity under any stated thermal conditions."

As a result of the studies, new tables of current carrying capacities were established. These tables generally permit currents 5 to 25% higher than most published data. Using these figures as a guide, several projects were postponed, resulting in substantial savings in fixed charges for deferred construction.

The saving at subtransmission and distribution voltages is not expected to be spectacular, but there could be a significant saving in the cost of tie lines, substation exits, service entrances and similar short lines where voltage drop or economic loading is not a prime consideration.




**AMPACITY VARIES** with both wind velocity and ambient temperature for all conductor sizes. Design limits for both factors are dashed horizontal lines




### Assume Local Standard

A key to the difference between old standards and the new tables lies in the difference in assumed weather conditions. For example, it was assumed that minimum wind in the Lower Peninsula of Michigan would be 2 mph, instead of the "no wind" condition on which national standards are based. The effects of the change in assumed wind velocity and ambient temperature for typical conductors are illustrated in charts at left. The amount of forced air cooling, the ambient temperature, the proximity of other radiating bodies, and surface conditions all affect conductor thermal capacity.

General thermal characteristics can only be approximated, because variations in source of supply, impurities, and even methods of drawing the metal into conductor have a marked effect on results. A 10% loss in ultimate strength is the limit beyond which a conductor is considered "sacrificed" and subject to replacement because of abnormal sags.

For the Consumers Power system, local hourly climatological reports were studied for the current 10-year period. The Lansing weather bureau was selected as the most centrally located in company service area. Maximum temperatures were compared with coincident wind velocities. These were recorded and curves drawn on the basis of frequency.

As suspected, high temperatures

# "Ampacities"

do not persist for more than three hours in a semi-maritime area such as Michigan, and are invariably accompanied by wind velocities of 5 mph or better. Temperatures are moderated by the bodies of water surrounding the state. Local climatological data available from the U. S. Department of Commerce indicate that sustained temperatures over 100F occur less than once in four years. A temperature of 95F with 2-mph wind or less, or its equivalent, occurs an average of 72 min a year in the Lansing area.

Therefore a summer ambient temperature of 35C (95F) was assumed for the March-to-November period, and a winter ambient of 10C (50F) for the remaining period. A minimum 2-mph wind was also assumed.

The bare conductor temperature selected was 100C (212F) for normal conditions and 140C (284F) for emergency. Emergency ratings are not used for covered conductors, and temperatures are limited to 80C (176F) on the surface of braid coverings and 75C (167F) under rubber-insulated conductors for low-voltage applications.

Emergency conditions apply to unusual loads over a cumulative period of 10 hr for copper and up to 40 hr for all-aluminum. The time limitation is not critical for ACSR because the steel core is not appreciably affected at 140C and over-all strength is not reduced appreciably. The same applies to copper-clad steel conductors.

The conductor will not be "sacrificed" except during a disaster period. A "sacrificed" conductor still retains 90% of its original strength and can be operated safely. Philadelphia Electric Co has operated a 4/0 copper circuit at 135C for 44 hr and at 175C for 4 hr during an emergency without failure of the conductor or automatic line splices. Operations at 200C for several hours, however, annealed the conductor beyond safe operating limits.

The short annealing life at normal loading and 100C temperature is extended indefinitely by several factors:

**1.** The wind velocity and ambient temperature assumed is conservative enough to occur less than 1% of the hours in a year.

**2.** Peak loads are usually seasonal and occur during a small percentage of hours in a year. But air conditioning is changing load patterns in many areas.

**3.** A conductor is seldom subjected initially to maximum loading, because conductor size is usually based on long-term loading.

**4.** Peaks of short duration have little effect on annealing because a period of 15 min to an hour is required, depending on conductor size, for the conductor temperature to rise from ambient to 100C.

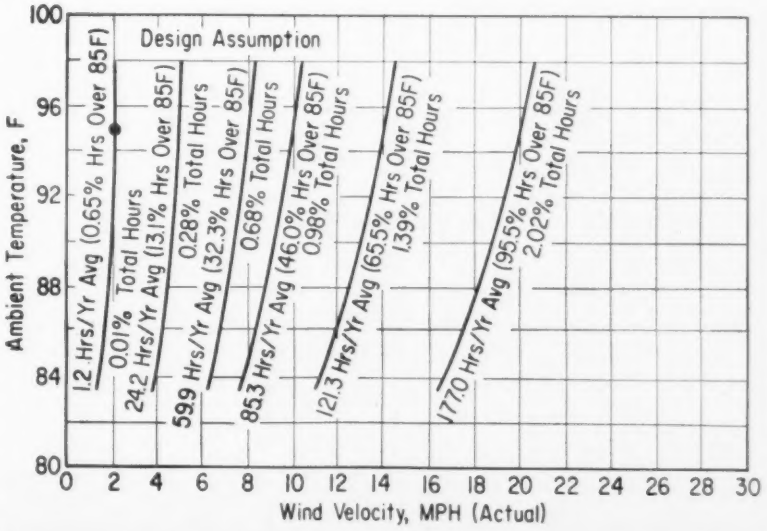
Only ampacities for weathered conductors will be made available

## Maximum Ampacity of Bare ACSR and Aluminum Conductors

| | Normal Operation | | | | Emergency Operation | | | |
|---|---|---|---|---|---|---|---|---|
| | New ACSR | | Weathered ACSR | | New ACSR | | Weathered ACSR | |
| Size | Summer | Winter | Summer | Winter | Summer | Winter | Summer | Winter |
| No. 4 | 165 | 195 | 180 | 210 | 200 | 225 | 220 | 245 |
| No. 2 | 225 | 260 | 245 | 280 | 275 | 305 | 300 | 330 |
| No. 1 | 265 | 310 | 285 | 330 | 315 | 350 | 345 | 380 |
| 1/0 | 305 | 360 | 330 | 380 | 370 | 400 | 405 | 435 |
| 2/0 | 355 | 420 | 385 | 450 | 430 | 475 | 470 | 520 |
| 4/0 | 485 | 565 | 525 | 615 | 580 | 645 | 645 | 710 |
| 266.8 | 565 | 660 | 615 | 720 | 680 | 755 | 760 | 835 |
| 336.4 | 660 | 770 | 725 | 840 | 800 | 900 | 890 | 1,000 |
| 477 | 840 | 965 | 915 | 1,060 | 1,010 | 1,120 | 1,125 | 1,250 |
| 636 | 1,000 | 1,280 | 1,125 | 1,310 | 1,230 | 1,350 | 1,370 | 1,520 |
| 795 | 1,160 | 1,350 | 1,295 | 1,500 | 1,410 | 1,580 | 1,600 | 1,780 |
| 954 | 1,300 | 1,520 | 1,455 | 1,690 | 1,575 | 1,745 | 1,795 | 1,970 |
| 1,192 | 1,415 | 1,660 | 1,580 | 1,850 | 1,715 | 1,925 | 1,960 | 2,165 |
| 1,351 | 1,530 | 1,790 | 1,725 | 2,000 | 1,845 | 2,035 | 2,105 | 2,300 |
| 1,510 | 1,645 | 1,930 | 1,860 | 2,160 | 1,970 | 2,180 | 2,270 | 2,470 |
| 1,590 | 1,705 | 1,995 | 1,935 | 2,245 | 2,050 | 2,265 | 2,360 | 2,530 |
| | New Aluminum | | Weathered Alum. | | New Aluminum | | Weathered Alum. | |
| 350 | 640 | 755 | 710 | 840 | 785 | 865 | 870 | 960 |
| 800 | 1,130 | 1,330 | 1,250 | 1,475 | 1,370 | 1,510 | 1,520 | 1,680 |

Ratings based on two-mph crosswind;
Air Temperature, 35C Summer, 10C Winter; Conductor Temperature, 100C Normal, 140C Emergency; Conductor Radiation, 0.20 New, 0.80 Weathered.

Repeated or continued emergency loads of over forty hours duration cause annealing and reduction of ultimate strength.


Design Assumption
1.2 Hrs/Yr Avg (0.65% Hrs Over 85F)
0.01% Total Hours
24.2 Hrs/Yr Avg (13.1% Hrs Over 85F)
0.28% Total Hours
59.9 Hrs/Yr Avg (32.3% Hrs Over 85F)
0.68% Total Hours
85.3 Hrs/Yr Avg (46.0% Hrs Over 85F)
0.98% Total Hours
121.3 Hrs/Yr Avg (65.5% Hrs Over 85F)
1.39% Total Hours
177.0 Hrs/Yr Avg (95.5% Hrs Over 85F)
2.02% Total Hours
Ambient Temperature, F
100
96
92
88
84
80
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Wind Velocity, MPH (Actual)

**DESIGN ASSUMPTION** compared with weather data shows design load averages only 72 min per year. Conditions are not as severe as past assumptions

to Consumers Power Co's field personnel, because initial loads on new conductors are seldom critical and oxidation develops rapidly at higher temperatures.

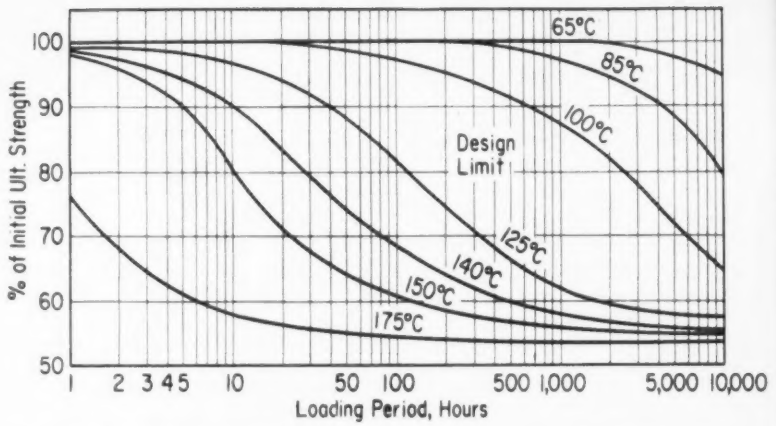
Because wind velocity is a major factor in determining ampacities, consideration is being given to the possibility of providing tables with several wind velocities listed. Comparison of weather data shows that wind velocity is reduced to 60 or 70% of that in unrestricted areas, when trees and buildings are present. This will have to be taken into account for urban construction.

Factors other than thermal, voltage and economic considerations influence the maximum current a conductor can carry. The ability of connectors and splices to function properly under alternate heating and cooling is being studied.

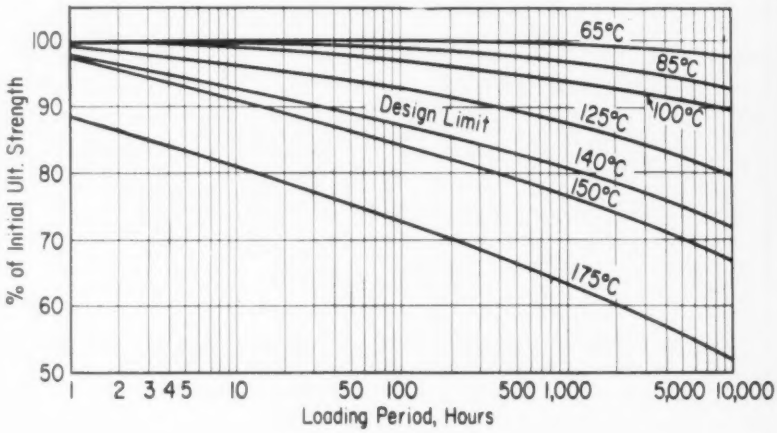
All present and proposed connectors must pass a 500-cycle test at the ampacity of the recommended conductor without getting hotter than the conductor or indicating a trend toward deterioration through increased resistance or heating. All connections, splices and conductors are tested in the "as received from stores" condition. Specimens prepared by wire brushing through an anti-oxidant paste are not used for check tests. Tests were also run on unprepared samples, including old salvaged splices and new splices applied to tarnished conductors.

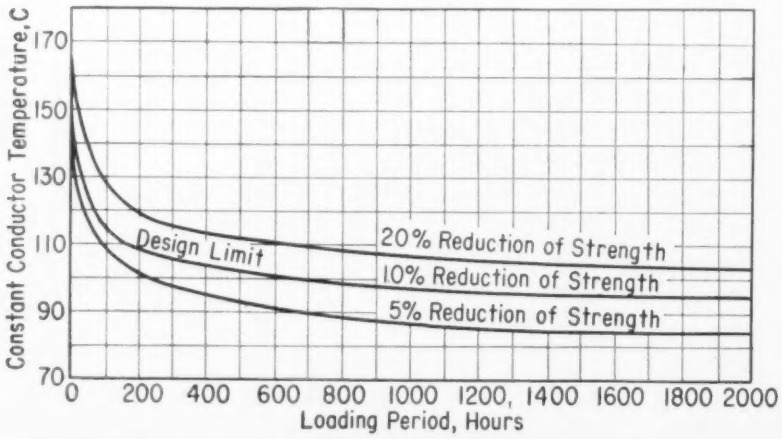
Tests indicate that properly applied connections and splices will be satisfactory at higher temperatures. Lines with questionable joints will be de-rated until corrected through routine maintenance.

Sags due to consideration of elevated temperatures will be checked against known critical clearances.




**ANNEALING** of copper and aluminum conductors reduces conductor strength. Loss of strength varies with loading temperature and duration of loading



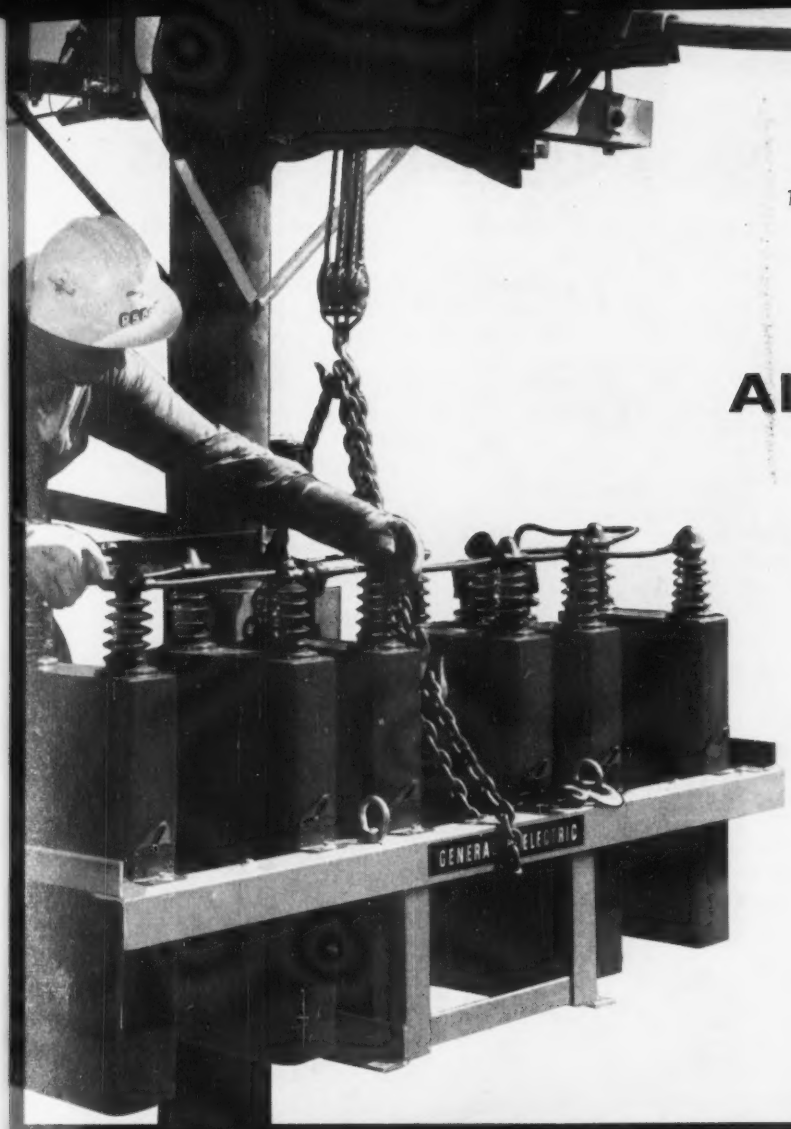




**PERMISSIBLE LOADING** periods of copper conductors vary with temperature and permissible loss of strength. A sharp temperature rise cuts loading time

Multi-circuit leads that are unevenly loaded thermally, sub-standard tree clearances, and certain long-span communication crossings may be sources of trouble. Also, bare or old 120/240-v service entrances with minimum spacings may cause trouble due to unequal thermal loading. In general, reduced clearance due to conductor sag should not be serious.

Although somewhat limited in application, more realistic tables of ampacity can provide a means for saving costly conductor replacement and help handle emergency loads.

The economic loading utilized for the design of the new lines is about one-third of normal summer ampacities and one-quarter of emergency ampacities. This reserve capacity in a few large circuits can be used to insure reliability for bulk power transmission instead of the more costly practice of providing a larger number of smaller circuits.



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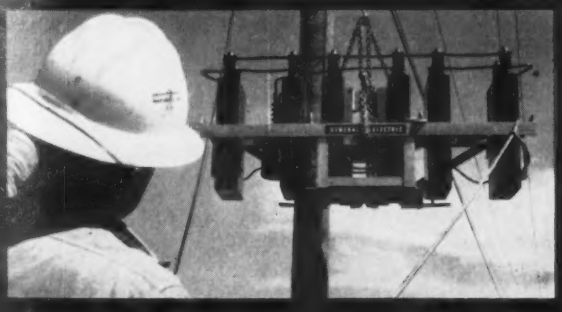
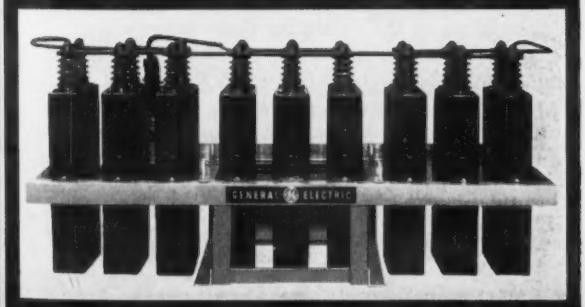
- **Corrosion-resistant to require less maintenance**
- **Braced to front-of-pole for maximum free climbing space**



**INSTALLATION IS EASY** with lightweight, structural aluminum racks and front-of-pole brackets and mounting arrangement.



**NO PAINT MAINTENANCE** is needed with G-E pole-top aluminum racks and stainless steel capacitor cases, helping to cut costs.

**15–20% less weight of G-E factory-assembled pole-top capacitor** equipments in aluminum racks makes installation fast, easy and inexpensive, and reduces bending moment on the pole.

**Maintenance costs are low, too.** Rugged, jig-welded aluminum structure will not require protective painting, even if drilled in the field. And, G.E.'s stainless steel capacitor case requires no protective paint maintenance.

**Front-of-pole mounting and bracing** affords ample free climbing space, provides greater safety, and contributes to ease of installation and connection to system.

**For more information** contact your G-E Apparatus Sales Office, or write to Section 445-21, General Electric Company, Schenectady, N. Y.

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**GENERAL ELECTRIC**

# Proper Grounding Reduces Hazards

## Proper safeguards can minimize shock hazards near substation switching areas

**A. ELEK,** Research Division, Hydro-Electric Power Commission of Ontario, Toronto, Ontario

The hazard of electric shock at substations during fault conditions may be minimized by appropriate safeguards, including design of grid system and addition of crushed stone fill where people stand. The steady increase in system capacity and increase in fault current magnitude have made such safeguards essential.

When fault currents flow through a station grounding system, the value of the potential difference between the station ground and a remote ground may increase considerably. A large portion of this potential difference may occur between adjacent points in the area, introducing a hazard to operating personnel.

The potential rise of station grounds under fault conditions can be decreased by reducing either the ground fault current or the ground resistance of the station. However, economic factors impose practical limits on the extent of such reductions.

By definition, the ground fault current in an effectively grounded system equals or exceeds 60% of the 3-phase fault current. Reduction of the fault current to a value less than 60% of the 3-phase fault current would result in higher fault voltages, necessitating an increase in the system insulation level.

Reduction of the ground resistance also has certain economic limitations. A ground resistance lower than 0.1 ohm is usually too costly to obtain, especially at locations where the soil resistivity is high. Values up to several ohms are often encountered. Hence in many stations a possible potential rise of several thousand volts cannot be prevented economically.

For the design of practical protective measures, a distinction must be made between step voltage and touch voltage. Step voltage is defined as the potential difference occurring between a person's two feet, and touch voltage as the potential difference occurring between a person's feet and one hand.

The concept of step voltage is illustrated in Fig. 1, body current ($i_s$) and step voltage being related through the formula:

$$i_s = \frac{\Delta V_1}{R_b + R_s}$$

where

$V_1$ = potential difference between the points of contact of each foot with the ground, measured with the body removed; that is, as if the body had infinitely high resistance.

$R_b$ = resistance of the body, assumed to be 750 ohms under the most unfavorable conditions.

$R_s$ = resistance in series of the two feet.

The concept of touch voltage is illustrated in (Fig 2), body current ($i_t$) and touch voltage being related through the formula:

$$i_t = \frac{\Delta V_2}{R_b + R_p}$$

where

$V_2$ = potential difference between the station structure (touched) by one hand) and the point of contact of the feet with the ground, measured with the body removed.

$R_b$ = resistance of the body (750 ohms)

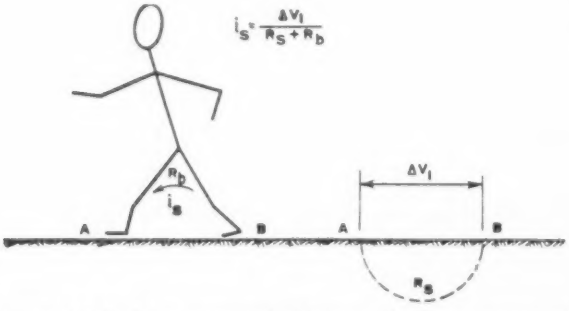
$R_p$ = resistance in parallel of the two feet.

According to C. F. Daltiel the dangerous body current may be expressed as $i = \frac{0.17}{\sqrt{t}}$ where t is the shock duration in seconds.

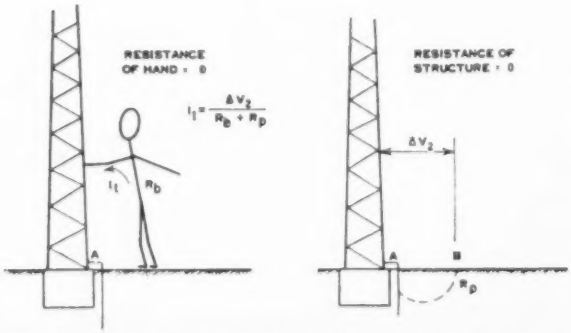
The potential gradients around structures can be controlled by burying bare conductors, connected to the base of the structures, around the individual structures. These grading conductors are formed in shapes similar to those of the structures they surround.

The dimensions are so chosen that any point on the grading conductor is about 3 ft from the closest point on the structures (average arm reach). In the immediate proximity of the structure the step voltage is considerably reduced, as is also the touch voltage. At some distance from the structure, however, the step voltage is slightly higher than without the grading conductor. Ontario Hydro tests showed that the grading rings reduce the maximum touch voltage by 30%.

(*Continued on page* 82)




**STEP VOLTAGE** is potential difference between points of contact of each foot with ground, with the body removed




**TOUCH VOLTAGE** is potential difference getween station structure and the point of contact of the feet with ground

*GENERAL ELECTRIC INTRODUCES*

# NEW reliable, twist-lock photoelectric control

The new General Electric photoelectric control—designed for years of reliable service—will save you money in the long run.

Here are five reasons why:

1. Built-in Thyrite* surge protection at no extra cost.
2. Long tube life achieved by continuous burning of amplifier tubes at well below their rated values.
3. Relay contact (the only moving part) built and tested for years of reliable service.
4. Basic circuit proved dependable by years of actual field operation.
5. Quality construction, with printed circuit and dip-soldered connections.

For long-range economy in your street-lighting control circuit, call your nearby G-E Apparatus sales engineer or agent and ask to see the new twist-lock photoelectric. Or, write today for all the details. General Electric Company, Schenectady 5, New York. 450-8

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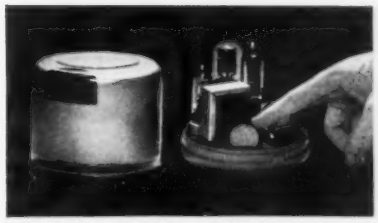
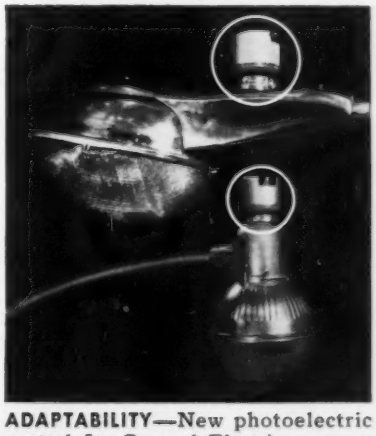
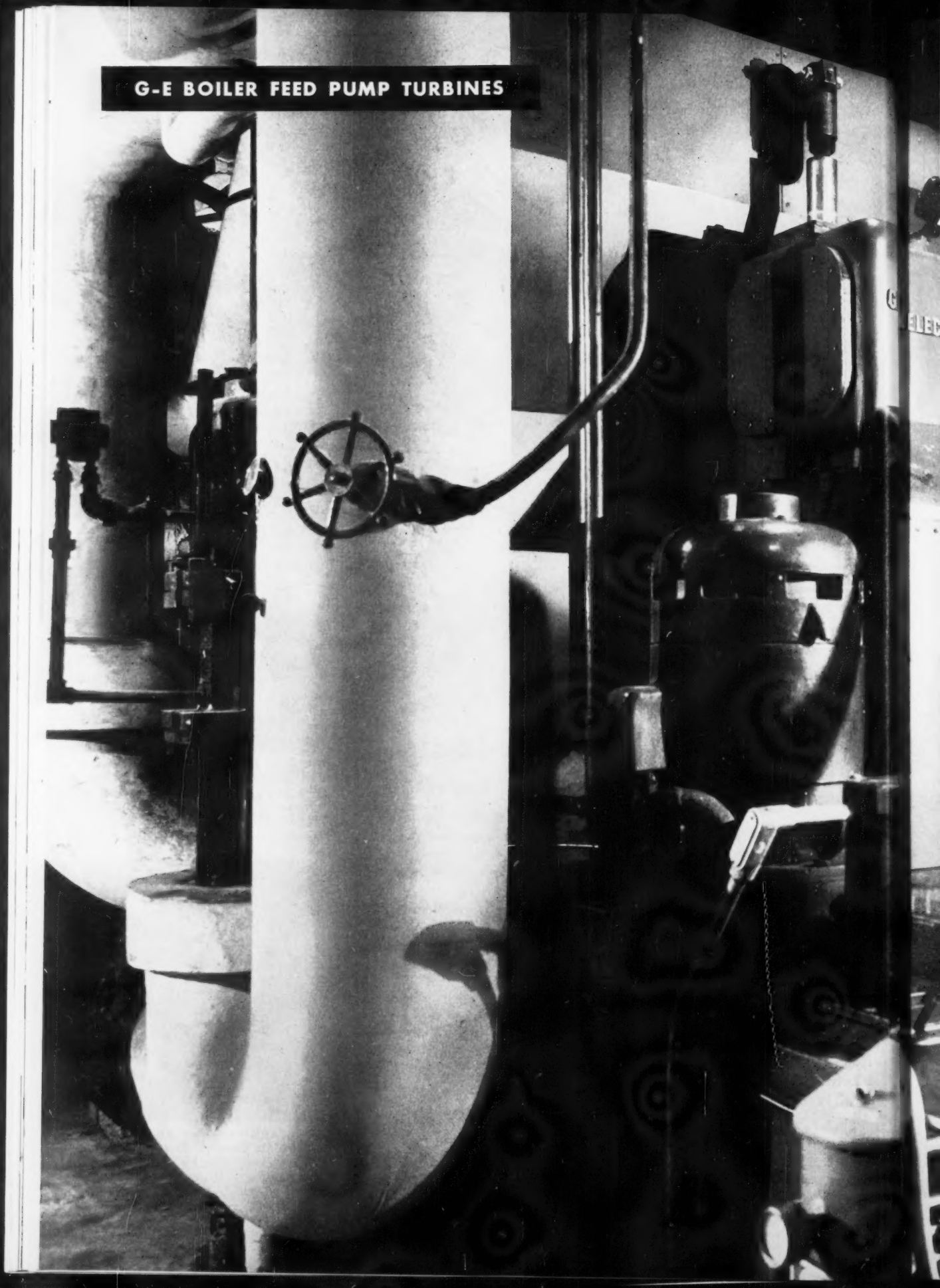


**BUILT-IN THYRITE* PROTECTION**—an exclusive G-E feature—guards against damage from induced voltage surges, eliminates added cost of external secondary arrestor.

*Reg. Trade-mark of General Electric Co.



**ADAPTABILITY**—New photoelectric control fits General Electric mercury "Power Pack" (top) and mercury or filament Form 101 hoods, and is designed to NEMA and EEI standards.


G-E BOILER FEED PUMP TURBINES

Boiler Feed Pump Turbines
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# PROFITABLE POWER

## 29 General Electric units installed and ordered give evidence of wide utility acceptance

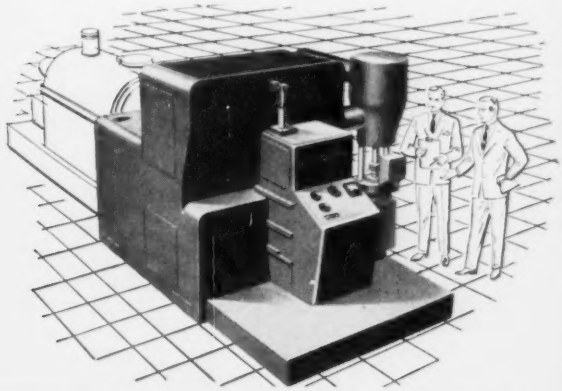
In less than four years, 13 electric utilities have ordered 29 General Electric boiler feed pump turbines to supply feed water requirements for a total of 7,413,000 kilowatts of generating capacity. Ten of these compact units are currently in operation providing utilities with more saleable kilowatts.

Pictured here is a General Electric boiler feed pump turbine which supplies feed water for Unit No. 67 at Niagara Mohawk Power Corporation's Huntley Station. To facilitate piping, the turbine is located at grade level directly below the main unit.

**Why the growing acceptance?** Continuing trends to greater capacity and higher pressure in large steam-electric generating stations have created demands for boiler feed pump turbines to improve efficiency and reliability at higher pump operating speeds. Economic gains are also realized because turbine drives for boiler feed pumps release auxiliary power to increase net saleable station output.

**Extensive application experience** in diverse utility operations is your assurance that General Electric is prepared to engineer, manufacture, install, and place in operation boiler feed pump turbines that fit your particular operating requirements.

For more information on how you can benefit by using General Electric boiler feed pump turbines, contact your nearest Apparatus Sales Office, or write for Bulletin GEA-6541, General Electric, Schenectady 5, New York.

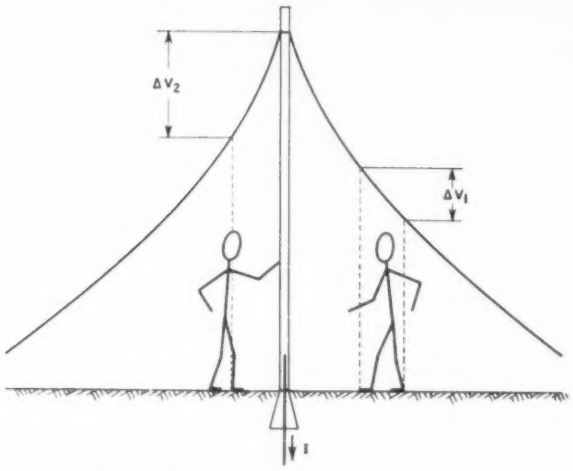


**TYPICAL** General Electric boiler feed pump turbine designed to provide electric utilities with more profitable power.

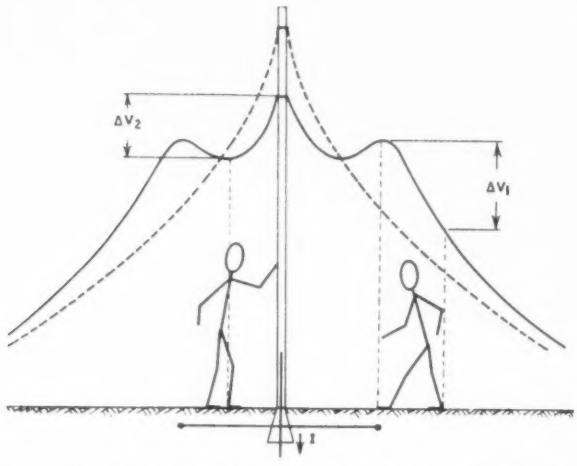
*Progress Is Our Most Important Product*

GENERAL ELECTRIC

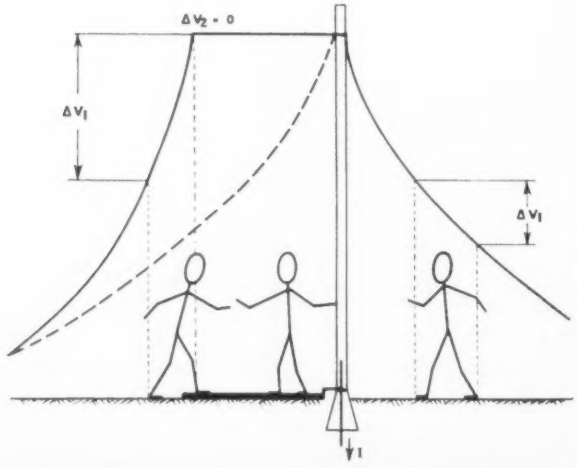
241-13




**POTENTIAL PROFILE** around a current-carrying ground electrode can be illustrated with respect to a remote ground




**GRADING RING** can reduce step and touch voltage in proximity of conductor. Farther away step voltage increases




**GROUND MAT** completely protects against touch voltage. Person with one foot on mat is exposed to high step voltage

If a metal ground plate connected to the structure is laid on the soil surface, a person standing on the plate will be completely protected from touch voltage. Such a permanent ground mat can be used where switching operations must be done manually. In this instance, a person standing with one foot on the ground mat and the other on the soil would be exposed to a step voltage equivalent to touch voltage.

Both the step and touch voltages can be effectively reduced by using grounding grids. These grids, formed by interconnecting the grounds of all the station structures, provide a nearly uniform potential gradient throughout the station area. The potential differences between adjacent points depend upon mesh width.

The highest step voltages occur at the periphery of the grounding grid. To ensure that touch voltages will be minimized at locations where manual switching is frequently done, the dimensions of the grid mesh can be made as small as necessary.

Covering the surface of the ground with a layer of crushed stone will also reduce the current likely to flow through the body. The stone, having a relatively high resistivity, provides an insulation in series with the body, while the grading conductors, ground mats, and grids conduct in parallel with the body.

Ontario Hydro tests indicate that on a 3-in. wet layer of large stones (½ to 1 in.) a person's feet have a higher resistance than on a 3¾ in. layer of smaller (up to ½ in.) stones. The increase can be attributed to the smaller area of foot contact on the larger stones, and the fact that the larger stones will retain less water after being soaked. The tests show that the use of crushed stone reduces the body current by at least 50% if the underlying soil is a good conductor.

### Stone Should Be 3 in. Thick

A layer of crushed stone less than 3 in. thick should be considered unsafe. A greater possibility exists that with such a thin layer, the soil may become exposed in spots. Also, the layer may not be thick enough to completely cover pools of water which may form if the underlying soil is relatively impervious.

If a grid network has been used within the station to limit the potential gradient, the fall of potential will be greatest along the grid periphery, and persons or animals approaching the area may be endangered. To eliminate this hazard, the station fence should be isolated from station ground and grounded separately.

Measures must be taken in this case to prevent a person inside the station from simultaneously contacting the fence and the station ground. Such a contact could subject the person to a voltage almost equal to the total potential rise in the station at the moment of fault. No metal parts connected to the station ground should therefore be within 5 ft of the fence. If the distance between the fence and the station ground cannot be at least 5 ft, the fence must be connected to the station ground.

If the fence is connected to the station ground, the danger zone will be located outside the fence. Under these circumstances the use of grading conductors around the fence and a thick layer of crushed stone outside the fence should decrease the hazards. Without such measures, at small stations fence touch voltages as high as 40% of total potential rise were measured.

# Quality in Victor suspensions is more than skin deep

VICTOR No. 924
(EEI-NEMA TDJ 52-5)
25,000 lb. SUSPENSION INSULATOR

## . . . IT GOES ALL THE WAY THROUGH

From glaze, through porcelain to cap and ball bolt, VICTOR's quality control never stops. VICTOR compounds and manufactures its own glaze . . . glaze that properly fits itself to each insulator, giving high strength and unequalled self-cleaning qualities. Only VICTOR makes its insulators of Purified Porcelain . . . purest, hardest, strongest insulator porcelain ever made! And VICTOR caps and ball bolts are accurately made, double-dip galvanized and 100% gage-tested to insure proper mating, complete interchangeability and conformance to EEI-NEMA Standards.

## DID YOU KNOW GLAZE IS REALLY GLASS?

Glaze is what gives a VICTOR Suspension its handsome, glossy appearance. What's more important, however, is that it adds to its durability, strength and self-cleaning characteristics. Glaze is actually glass (with a color pigment added) . . . and nothing cleans easier than glass. To make certain that its glaze is of highest quality, VICTOR makes its own. It is prepared by grinding the glaze mix in a rotating ball mill lined with porcelain brick and filled with thousands of porcelain balls. The mill grinds the glaze to a fineness of less than 10 microns. Each batch is pre-tested and matched to the type of insulator being glazed in order to conform with VICTOR's high standards.

## WE GIVE 'EM A REAL BEATING

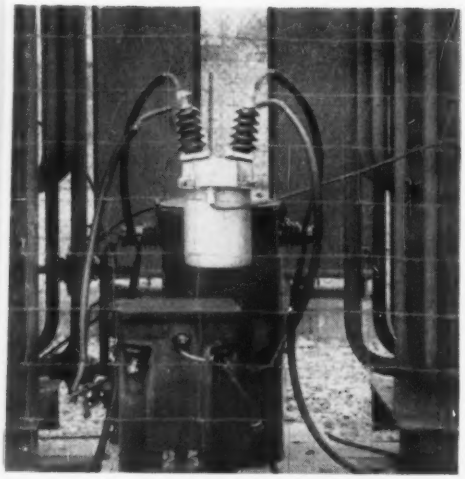
The VICTOR Suspensions that go on your lines will never have to take the mechanical and electrical loading we give them in the VICTOR laboratory. In fact, our continuous quality control testing program shows that No. 924-25,000 lb. suspensions proof-test, under both electrical and mechanical loading, at values far in excess of EEI-NEMA Standards.

## WATER WE USE AT VICTOR IS FAR TOO PURE TO DRINK

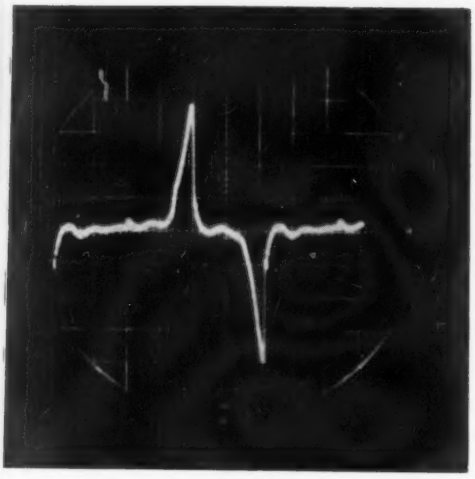
The water used in making Purified Porcelain is about as pure as you'll ever find. In fact, it's the reason why Purified Porcelain is the hardest, densest and most durable insulator porcelain ever made. But did you ever try to drink it? Ptui! It's wet and that's all. No taste. Everything that gives drinking water its taste—has been removed by VICTOR's demineralizing process. It isn't worth a plugged nickel for drinking . . . but it sure makes a great porcelain. For specifications, and prices on VICTOR Suspension Insulators, write I-T-E Circuit Breaker Company, Victor Insulators Division, Victor, N. Y.

**I-T-E CIRCUIT BREAKER COMPANY**
**VICTOR INSULATORS DIVISION**

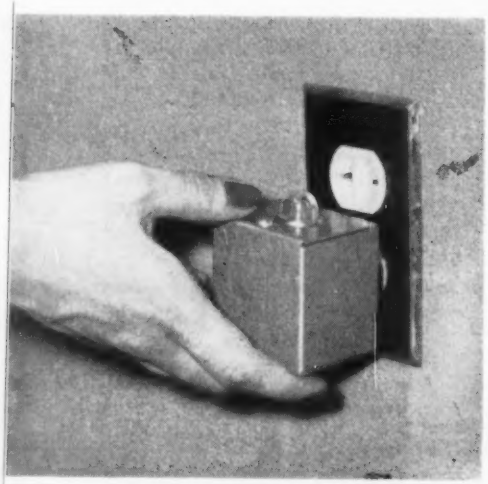
# Civil Defense Alarm Proves Feasible



Reactor and switch . . .



Produce harmonic signal . . .



Sounding local alarms

**ARTHUR LAUDEL,** Head, Electrical Engineering Section, Midwest Research Institute, Kansas City, Mo.

An emergency warning system, actuated by power line carrier, has been successfully tested on a utility network. The warning system, called NEAR (National Emergency Alarm Repeater), was developed by Midwest Research Institute in cooperation with the Office of Defense and Civilian Mobilization. The test installation was made at Consumers Power Co's Princeton Substation, serving Battle Creek, Mich.

The NEAR signal is composed of the second and fourth harmonic voltages of the 60-cps power frequency. These harmonic voltages are induced in the power line by a dc-excited reactor. Reactors may be connected either in series with or shunted across the phase.

The alarm signal is sensed by receivers which are plugged into power outlets throughout the area. These receivers contain alarm devices to alert everyone within audible or visual range. The signal reaching adjacent areas and utility networks is adequate to trigger receivers which, in turn, actuate signal inductors and start a chain reaction that may be repeated from utility to utility across the country.

The NEAR system signal inductors are suitable for continuous service. It is anticipated that the signal duration would range from about 30 sec to 3 min. During the nonsignaling condition, the excitation winding of the series signal inductor is shorted through the signaling switch, and the load current (times the turns ratio of the signal inductor) flows in the excitation winding. The signal inductors are insulated at the same voltage level as the line, contain the same basic insulation level as conventional transformers and are mechanically and electrically designed to withstand short circuit currents which might occur on the system.

The 60-cps voltage variations produced on the power system because of the introduction of a 2% harmonic signal are about 2½%.

Although the equipment is rated to produce a continuous signal, signal durations may be as short as a part of a second. Thus the NEAR system can be used for signaling services in addition to the home warning function. The home warning receivers will contain a time-delay element which rejects the first 5 sec of a signal. If the bits for coded signals are about 1 sec each, signaling functions can be provided to control off-peak loads, traffic lights, street lights and signaling of personnel for emergency duty.

Because the receiver incorporates a time delay, any signals which might be generated by switching transients, lightning surges, and asymmetrical voltage swings resulting from faults will not cause false operation of the receiver.

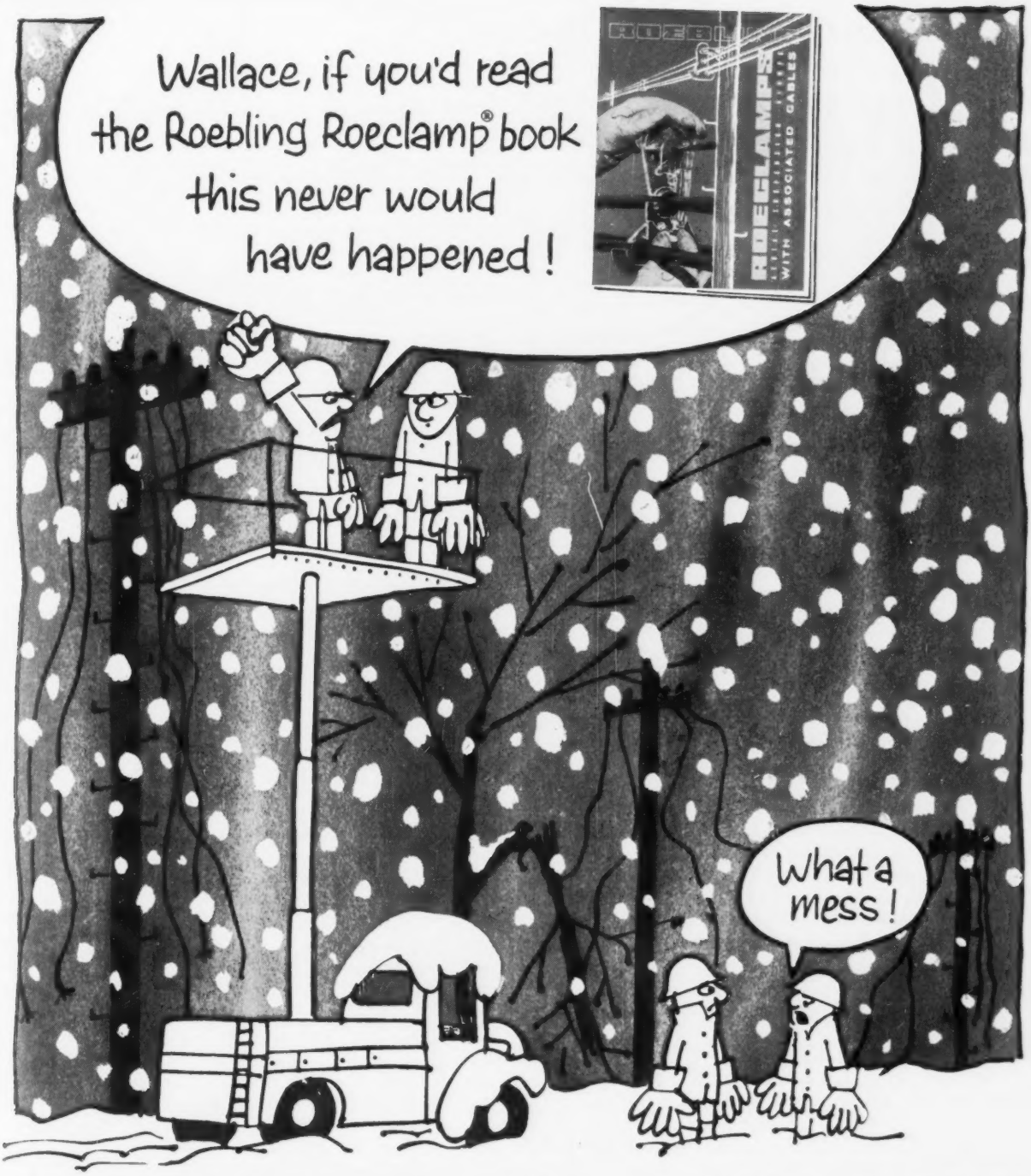
### Distribution Transformers Used

In the Princeton Substation test, conventional distribution transformers were used as inductors. The low-voltage sides of the distribution transformers were connected between the neutral sides of the substation transformers and the neutral itself. Silicon junction diodes were used to provide de-excitation current which saturates the core, producing second and fourth harmonics.

The rectifier voltage rating was made considerably higher than the normal excitation voltage so that the rectifier could withstand the momentary unbalances created by the non-simultaneous operation of the switches and by the switching transients themselves. In order to limit transient voltages, a Thyrite stack was connected across the rectifier.

Test results showed that presence of the signal produced no harmful effects. There was no detectable induction of signal to a telephone line running parallel to the distribution circuit. A television set plugged in at a test point during signalling showed no noticeable effect as a result of the signal. No radio interference was detectable at the substation or along the distribution circuits.

The voltage dip produced during signaling was 1 v at a 127-v test point. This dip caused the voltage regulators in most cases to take one ⅝% step during signaling.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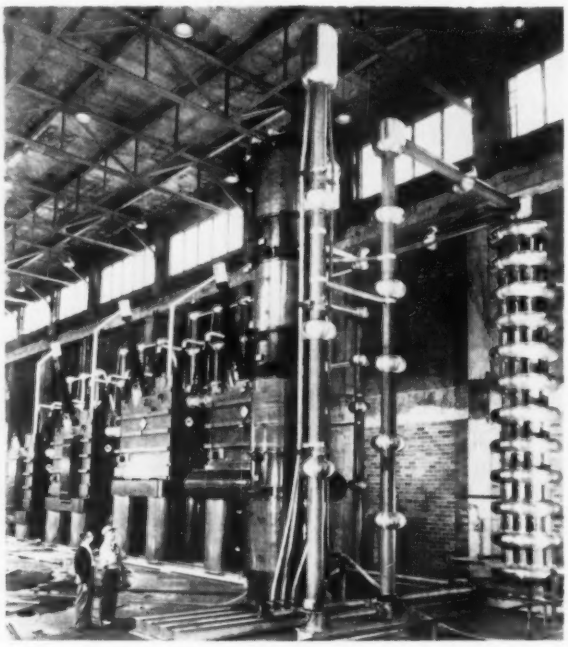
# Manufacturers News



## A-C Makes High-Voltage Silicon Rectifier System

A silicon rectifier power supply, 600-kw, 600-kv, has been built by Allis-Chalmers Mfg Co, Milwaukee, for the Atomic Energy Commission's laboratory facilities at Oak Ridge, Tenn. Built for Union Carbide Nuclear Co, it will be used in project "Sherwood" to study fusion. The installation is designed and insulated for 900-kv application, should it be required.

Four power transformers energize a 3-phase bridge rectifier, connected to provide full voltage desired for the operation. Filtered dc power is obtainable at several voltage levels from 150-600 kv, through electrical transfer.

Supply voltage of 13.8 kv is used for Allis-Chalmers switchgear, control, and a special regulator designed with two tap-changing mechanisms. These mechanisms allow near-zero to full-voltage output, with regulation as the load demands. Auxiliaries supplied included a specially designed transformer, rated 80 kva, single phase, and insulated for 900-kv dc.

### N-S's Copper-Plated Guy Unaffected by Year's Use

"Copperply," copper-plated down guy made by National-Standard Co, Niles, Mich., shows no corrosion after one year's use, according to Richard E. Koontz, company engineer. It was installed on a line adjacent to Twin Branch Station, near South Bend, Ind., as an experiment by Indiana & Michigan Electric Co, an operating unit of American Electric Power Co.

Three No. 8 wires form each Copperply guy. Each wire has a steel core with a copper coating electroplated to 30% equivalent conductivity and 25% cross-section area. Plated copper is 7.4 mils thick. Bond between copper and steel, developed during electroplating, is unaffected by binding and twisting of down-guy installations, says N-S engineer.

### GE Adopts Flat-Type Transformer Tubes

Triple-rated power transformers with flat-type forced-oil cooling tubes in place of round tubes formerly used are being built by General Electric Co, Schenectady. New tube design reduces floor space requirements, permits use of submerged-arc welding, which helps to assure stronger, tighter welds on radiators.

Transformers are designated OA/FA/FOA, replacing OA/FA/FA. They reach the third, or highest-rated cooling stage by operation of pumps in conjunction with fans. In light-load and intermediate-load stages, the pumps do not operate. Pumps are the same as those used on GE's forced oil-cooled units.

### Louisiana P&L Uses Porcelain Enamel on Boiler

Porcelain enamel has been used for the second time by Louisiana Power & Light Co as the outer skin for weather-proofing a boiler. Product of Avoncraft Division of Avondale Marine Ways, Inc., New Orleans, the enamel formed a complete roof over the top of the boiler and encased the sides, over the outer edges of the buck stays. It was also worked into the curvatures of the pre-heaters and stack uptakes.

The porcelain material for the job was prefabricated and porcelainized in the Avoncraft plant, eliminating fitting in the field which would produce raw edges subject to rusting. Installation on the boiler at Sterlington, La., required about three months.

### Westinghouse Reports Rise in Earnings, Dip in Sales

Westinghouse Electric Corp's 1958 net income rose to $74,772,000, compared to $72,652,000 in 1957, with net sales declining 5.6% from 1957's record high of $2,009,043,000. Total common shares outstanding at end of 1958 amounted to 17,180,028, an increase of 236,691 from 1957. Earnings per common share were $4.25, compared with $4.18 for the previous year.

The company reports net income for the year reflects a $7,470,000 federal income tax reduction attributable to the merger of several subsidiaries with the parent company. Chairman Gwilym A. Price and President Mark W. Cresap, Jr. say that, although total of new orders

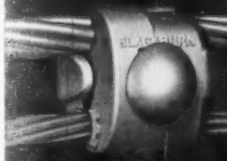
(*Continued on page* 89)

# Connect
# COPPER with COPPER
# ALUMINUM with ALUMINUM
## use...

PAC-5
ACSR 6—1/0 Cu. 8—1/0



PAC-3
ACSR 8—2 Cu. 8—2



PAC-4
(formerly PAC 6—0)
ACSR 6—1 0 Cu. 6—2

PAC-7 (replaces PARC 6—0)
ACSR 1 0—336.4
6—1 0 A/R Cu. 8—1 0

**BLACKBURN COPPER TO ALUMINUM FITTINGS**

# BLACKBURN PAC CLAMPS

## ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

*AVAILABLE THROUGH ELECTRICAL WHOLESALERS EVERYWHERE*

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# A MAJOR ACHIEVEMENT IN POWE

# the C-D 100

***Another C-D first!***

Utility engineers welcomed Cornell-Dubilier's introduction of the first individual capacitor unit rated to deliver a full 100 Kvar. It is available in standard voltage ratings of 4800, 6640, 7200, 7620 and 7960 volts.

Because it reduces by one-half the number of (50 Kvar) capacitors required for substation racks and pole-mounted banks, these 100 Kvar units occupy less space and cut installation and maintenance costs.

All of the advanced features exclusive with C-D power-factor capacitors — including the lowest volts per mil (333 v.) and power losses considerably below the NEMA limit of 3⅓ watts per Kvar are incorporated. Every unit is factory-energized for hours at full-rated voltage as a final quality check

Insure low-maintenance service from your next power-factor installation, by talking it over first with a C-D engineer. Just write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J. Dept. D-29.

CORNELL-DUBILIER CAPACITORS

**CORNELL-DU**

ACTOR CORRECTION...

The power factor capacitors that give you better than 99.6% trouble free DUBILIER service!

## Westinghouse Reports

(*Continued from page* 86)

booked during 1958 was slightly lower than in 1957, the backlog of unfilled orders at end of last year was about the same.

### Turbine Design

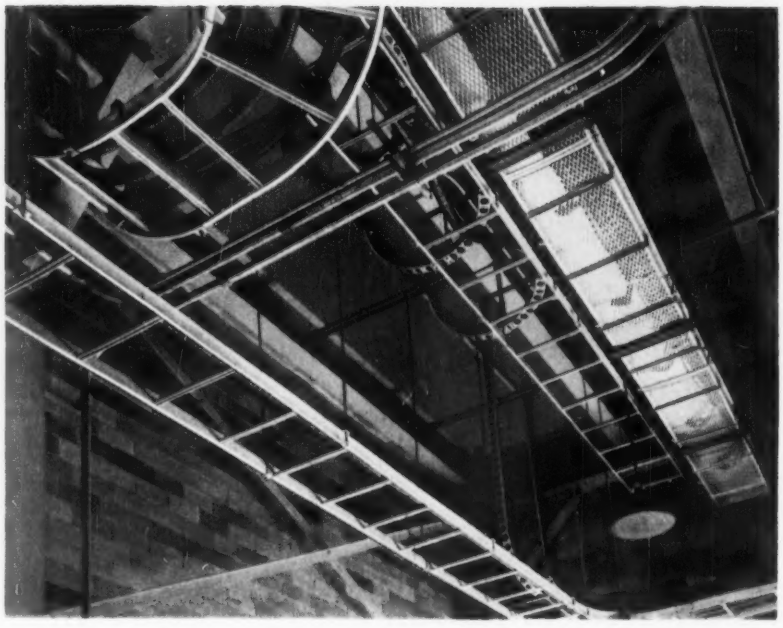
Westinghouse makes three significant turbine design changes.

- For high-pressure elements for 170-325 Mw turbines, the company's engineers in South Philadelphia have redirected the path of steam to achieve a lower temperature difference across the inner cylinder wall and better overall leakage efficiency. Former design of the element made the steam pass through the entire blade path and between inner and outer cylinders to be exhausted. With the new design the steam runs through ⅔ of the blading, between inner and outer cylinder walls and then back through the last third of the blading.
- Westinghouse has installed a new type of auxiliary governor on large steam turbines, which will serve as added protection against turbine damage if the generator should lose its load. The governor responds to acceleration instead of velocity. Further improvement in the governing system is the increase of oil pressure from 125 to 300 psi. Engineers are experimenting with 1000-psi components for possible future use.
- Supercritical-pressure turbine element being built by Westinghouse for Cleveland Electric Illuminating Co will be constructed from a ferritic, rather than an austenitic, steel alloy. There is a similar element in Philadelphia Electric Co's Eddystone unit. Steam inlet conditions of 3500 psig at 1100 F, with reheating at 1050 F were selected. Other turbine elements are similar to conventional tanden-compound, triple-exhaust, single-shaft units.

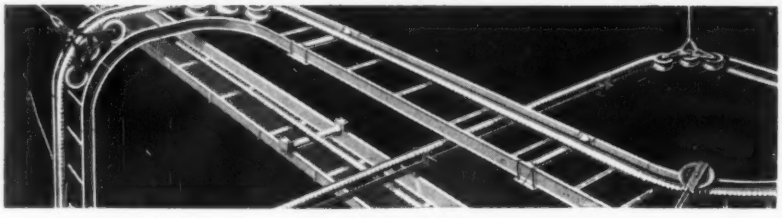
## Honeywell 800 System Scheduled for 1960

First deliveries of the transistorized medium-scale Honeywell 800 data processing system will be made in 1960, with substantial deliveries scheduled in the fourth quarter.

(*Continued on page* 90)



Cut Cable Support Costs with HUSKY Job-Engineered Systems!



**Save Space, Time, Maintenance**

❶ Compare the installed cost of cable in conduit or duct with Husky cable-in-free-air support systems. With Husky this cost is less.

❷ Compare the weight and cumbersome nature of conduit and ductwork with Husky cable-in-free-air. Husky racks, troughs, trays and baskets are lightweight, easy to handle, and the system is flexible, eliminating pull boxes and many splices. Save space . . . save time.

❸ Compare the maintenance costs and difficulties of adding more lines or making repairs with duct and conduit versus Husky maintenance-free aluminum supports, which are always accessible for making alterations.

Finally, compare other cable-in-free-air support systems, with the *electrically* as well as *structurally* sound Husky Cable Support System. When you've made the comparisons you'll understand why Husky is preferred by so many owners, engineers and contractors.

*Want proof? Write for free complete line Catalog or send us your cable support problem for analysis.*

*Representation from coast to coast*

HUSKY PRODUCTS, INC.

5300 Vine Street Cincinnati 17, Ohio

## Honeywell 800 System

(*Continued from page* 89)

according to Walter W. Finke, president, Datamatic Division, Minneapolis-Honeywell. Engineering prototypes of the computer will be available late this year, with operating equipment to follow in early 1960.

Finke said the Honeywell 800 is designed to accommodate input/output from other makes of peripheral equipment, as well as Honeywell's own line of equipments. The computer will accept directly computer programs compiled by the Fortran technique. In addition, Honeywell will provide compilers for business and scientific computer programming.

## NCR Launches Innovation for Computers

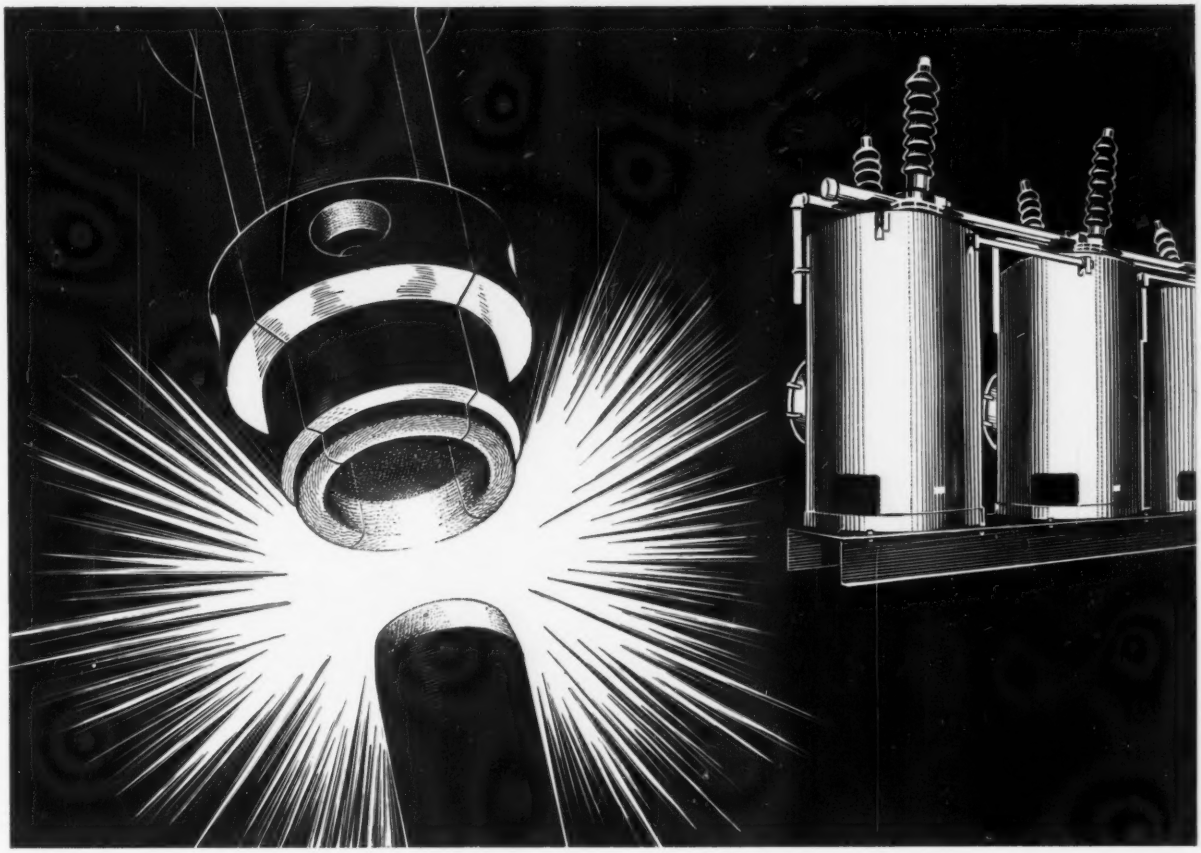
One of several current National Cash Register Co projects aimed at improving digital computer systems is a glass rod with a magnetic coating which serves as both a switching and information storage element. Research scientists at the company's Electronics Division in Los Angeles state the rod's dual usage will permit a reduction in number of semiconductors required. While some transistors will still be used, all switching will be performed by the rods and this will reduce the number of active components in a computer and increase reliability.

Solving problems with unprecedented speed and less costly production of computers in which rods are installed are operational and production advantages anticipated by N.C.R.

## MANUFACTURERS BRIEFS

**Hubbard and Co,** Chicago, offers 10-min, 16-mm, sound and color film on new EHD Faultmaster cutout. Movie demonstrates single-vent, small-bore design under operating tests in entire range of current, and highlights other subjects such as fuse links melting, results of closure on faults, mechanical

(*Continued on page* 92)



# Be Sure of Service By Specifying Elkonite® Contacts

There's a difference in contact materials . . . and the difference means a lot in the service you get from the equipment you buy. Extra performance in repeated making and breaking high-current circuits, in voltage regulators, circuit breakers, motor controllers and similar equipment, demands extra know-how in the development and manufacturing of contacts.

And that's what you get with Mallory Elkonite® contacts. These unique materials are the result of long experience by Mallory in applying special powder metallurgy techniques to combine refractory and conductive metals. For each circuit-breaking application, our contact specialists can control such factors as refractory particle size and methods of pressing and sintering to produce the optimum combination of hardness, strength, density, arc erosion resistance and electrical conductivity for the intended use.

Leading manufacturers have been using Elkonite® for many years, because they know the extra value and performance that Mallory engineers into them.

To make sure that your switchgear gives you top service, tell your supplier you want Elkonite® contacts.

**Serving Industry with These Products:**

**Electromechanical**—Resistors • Switches • Tuning Devices • Vibrators
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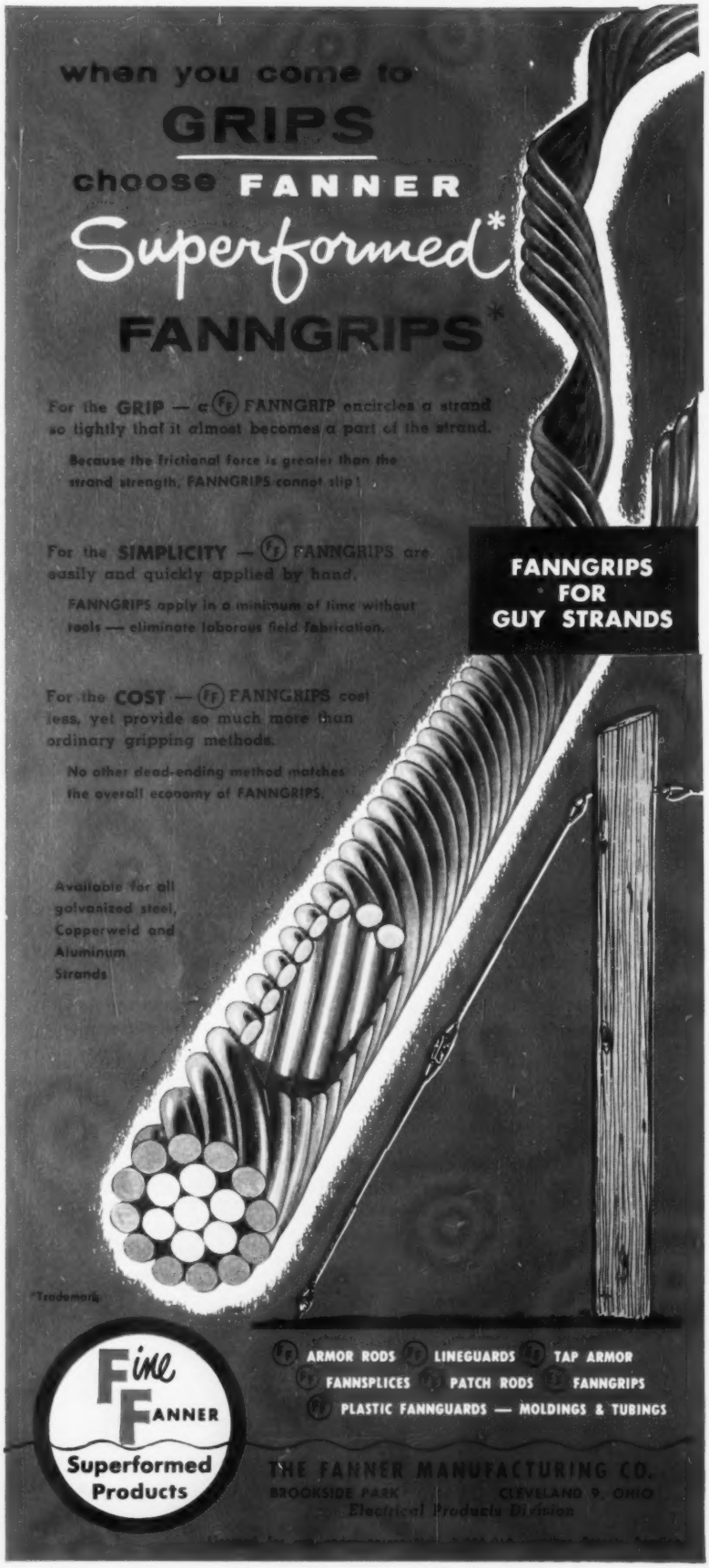
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For the GRIP — a FF FANNGRIP encircles a strand so tightly that it almost becomes a part of the strand.
Because the frictional force is greater than the strand strength, FANNGRIPS cannot slip!
For the SIMPLICITY — FF FANNGRIPS are easily and quickly applied by hand.
FANNGRIPS apply in a minimum of time without tools — eliminate laborous field fabrication.
For the COST — FF FANNGRIPS cost less, yet provide so much more than ordinary gripping methods.
No other dead-ending method matches the overall economy of FANNGRIPS.
Available for all galvanized steel, Copperweld and Aluminum Strands
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FF FANNSPLICES FF PATCH RODS FF FANNGRIPS
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BROOKSIDE PARK CLEVELAND 9, OHIO
Electrical Products Division

## Manufacturers Briefs

(*Continued from page* 90)

load-break operation. Address: Hubbard and Co, Advertising Dept, 200 S. Michigan Ave, Chicago 4, Ill.

**Moloney Electric Co,** St. Louis, Mo., applied permanent gold finish to large number of distribution transformers installed on systems of three northeastern utilities. Called "Badge of Distinction," shipments were Moloney's approbation for areas in systems having Gold Medallion homes.

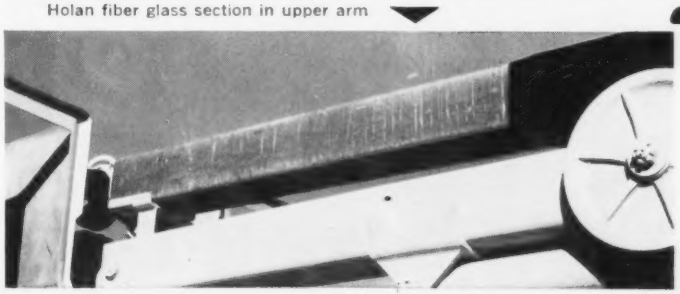
**Torq Industrial Power & Mfg Co,** Cleveland, O., has a new process which reportedly enables the user to reduce, by 90%, the time factor in the curing of repaired electrical equipment. Called the Torq Swirlair Thermo Controlled Curing Process, the unit will cure the normal class A, B, and F varnishes and insulation systems, as well as most of the class H varnishes and systems in the elevated temperature range. The equipment is not sold. Leased on a monthly basis, it is inspected periodically by Torq engineers.

**Remington Rand,** New York, reports its new line of Univac computers has a magnetic amplifier, solid-state commercial data-processing system. The computer has a capacity for 50,000 characters of information. An order has been placed by an Italian utility. Deliveries in the United States will begin in June, 1959, with the equipment renting at $6,950 a month. Purchase price will be $347,500.

**Four Wheel Drive Auto Co** has changed its name to FWD Corp to avoid the misleading connotations of the old name. FWD now makes heavy-duty trucks and other specialized vehicles in Clintonville, Wis.

**National Electrical Code,** 1959 edition, is in the process of being drafted, according to the National Fire Protection Association, Boston 10, Mass. The proposed new code is to be acted upon at the NFPA annual meeting, June 1-5, in Atlantic City, N. J. Review copies (AR II, price $1.25) may be ordered from NFPA, 60 Batterymarch St, Boston 10, Mass., for delivery in late April.

Holan fiber glass section in upper arm



## Holan Elbow has precise aircraft-type cable controls and strong, non-conductive fiber glass section in upper arm

With a Holan Elbow, it's easy to get to the problem—and safe when you get there.

The exclusive cable control system provides easy, precise spotting of the buckets. And a fiber glass section in the upper arm insulates workmen in the buckets from the ground. In a bucket-to-ground test, the non-conductive fiber glass section withstood 100,000 volts for one minute.

As for strength, in a separate test the fiber glass section required a 6,200-pound load at end before failing. This is a safety factor in excess of 7 as nominal capacity and weight of the buckets total 800 pounds.

Safety does come first but there are many operating features to talk about, too. Write for all the details.

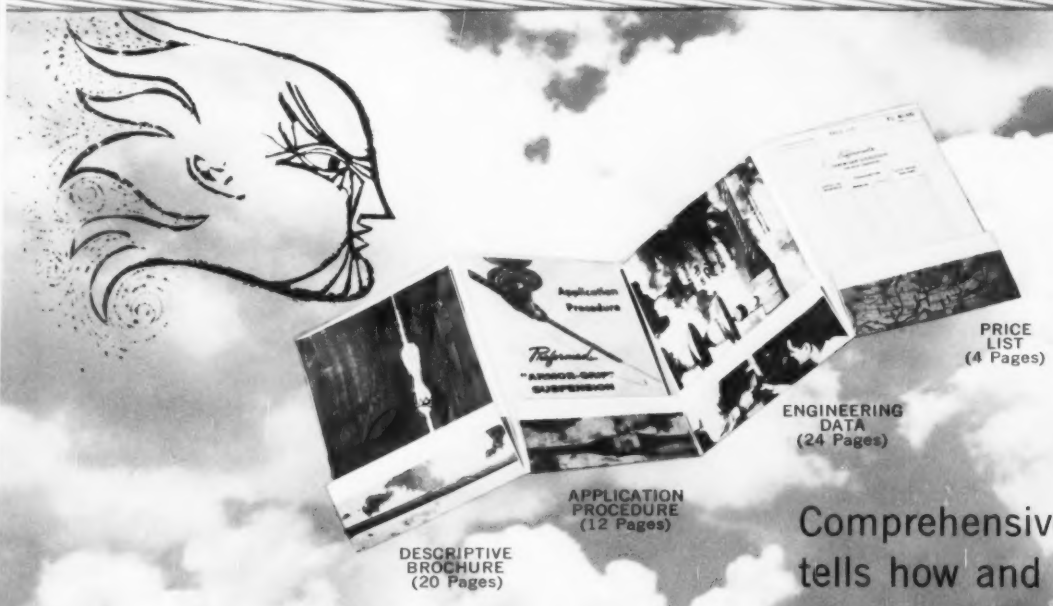
Holan Corporation, 4100 W. 150th St., Cleveland 35, Ohio
*Plants in:* Cleveland, Ohio; Griffin, Georgia; Phoenix, Ariz.

Holan

Subsidiary of THE OHIO BRASS COMPANY

HOLAN

# AGS* gets right to the C




Comprehensive new folio tells how and why AGS* eliminates line failures.

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**DEPT. A**

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CORE of line failure

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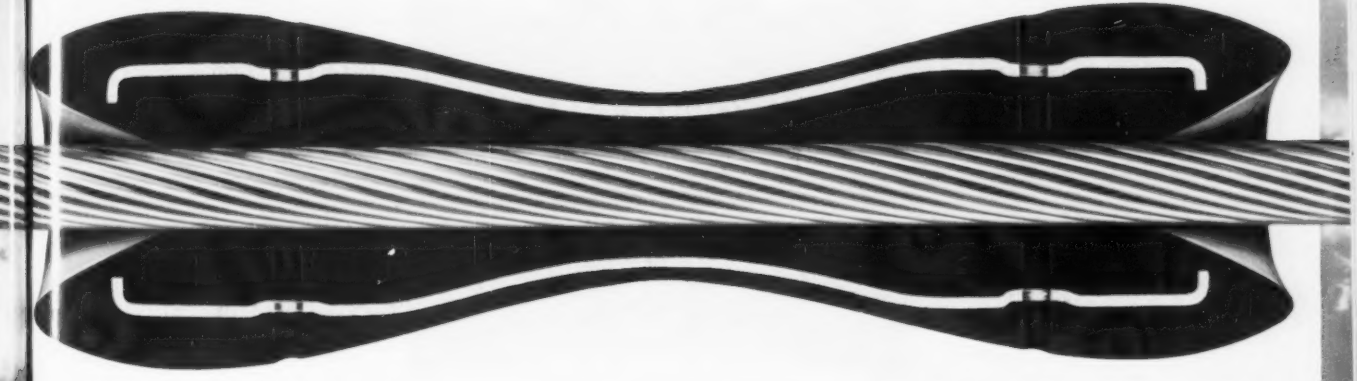


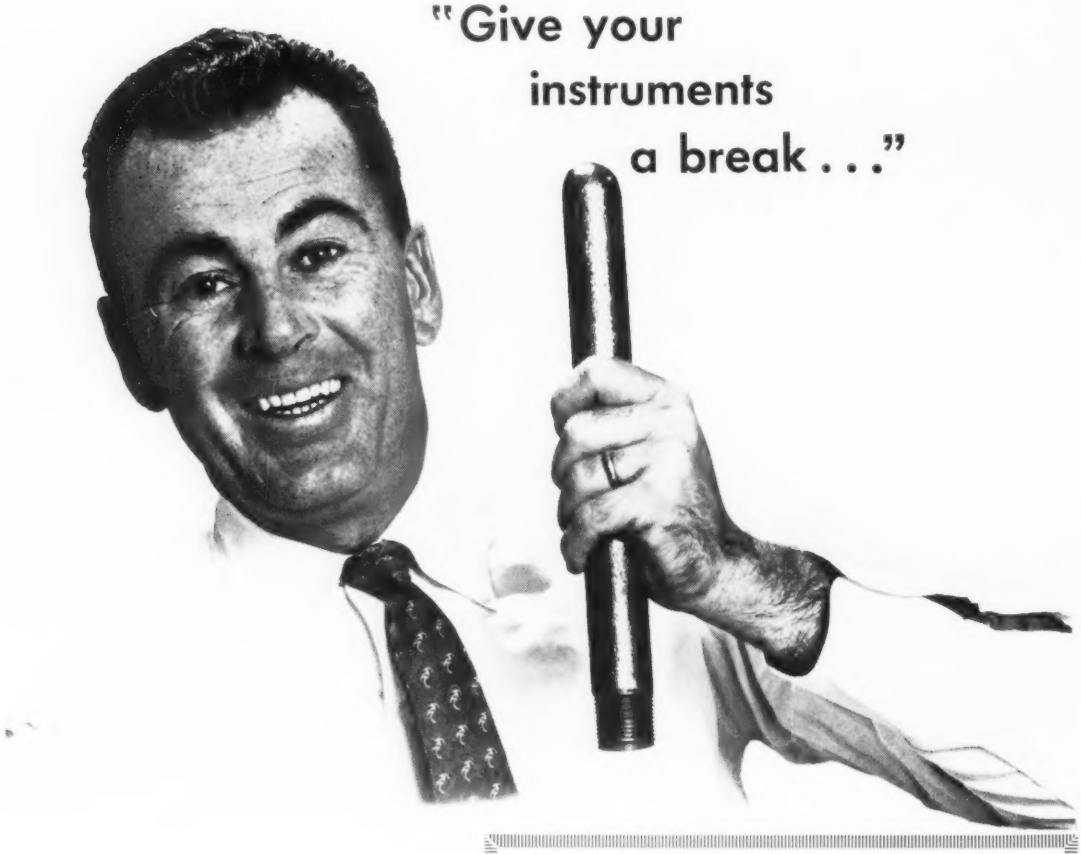
(on a vibrating conductor)

than the exclusive reinforced neoprene cushion inside the Preformed Armor-Grip* Suspension... AGS*

*You can look up to* Preformed*

Trade mark* Patented — U. S. Patent No. 2,722,393

# "Give your instruments a break . . ."



LET an instrument man make the perfect match between instruments and accessories. Your Honeywell instrument sales engineer knows your process and its controls, and which accessories are best suited to both. He can choose from a broad line of charts, inks, thermocouple wire, wells and protecting tubes.

Additional advantages gained from buying Honeywell accessories are service, economy and single-source purchasing. No shopping around. No need to "mix breeds." And you can be sure that whatever you buy will be right for the job. Your Honeywell instrument sales engineer will see to that. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

*Here's one product from the complete Honeywell accessories line:*

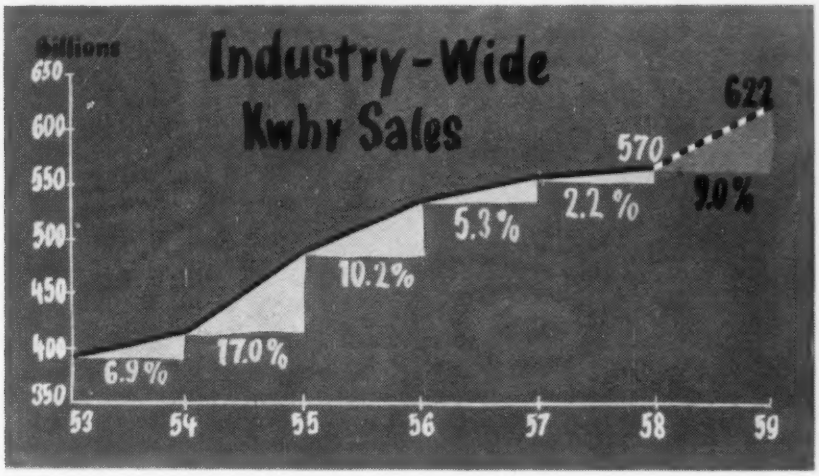
**CAST IRON T/C PROTECTING TUBES**

This is one of the protecting tubes recommended for use with molten aluminum or die casting applications. It can be used at maximum temperatures of 1300° F. in oxidizing atmospheres, and 1600° F. in reducing atmospheres. Available in standard lengths of 12, 18, 24, 30 and 36 inches.

All Honeywell cast iron protecting tubes are Beta-gage checked for uniform concentricity . . . assuring maximum life.

**Honeywell**

H HONEYWELL *First in Control*

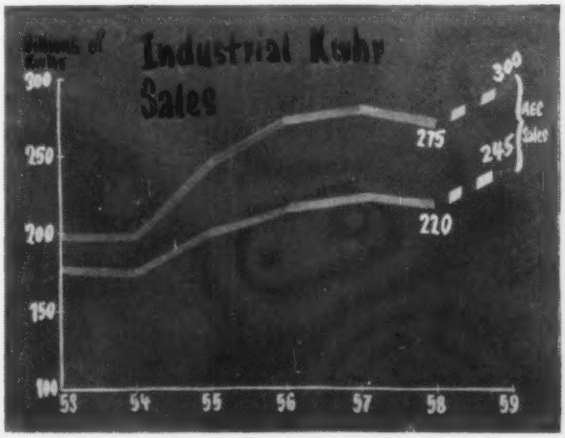



Report on
**Electrical Business Outlook**

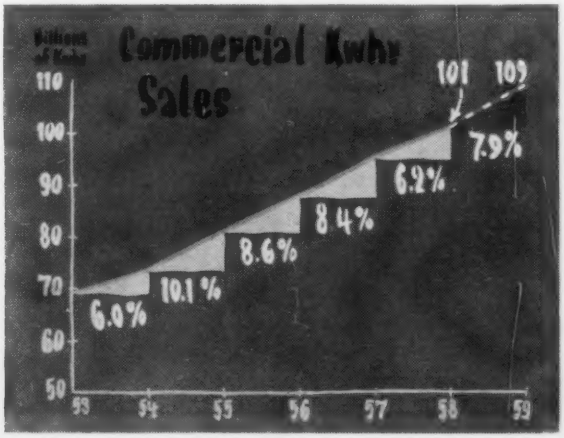
# The Utility Outlook—at a Glance

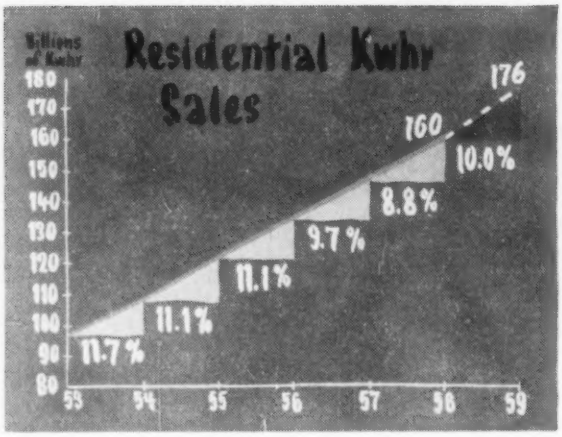
**The charts on these pages give a quick picture of the electric utility outlook** for 1959 and a visual summary of the industry's performance in 1958. The contrast looks good. Utilities were a tower of strength during the recession, but the fact remains that last year's 2.2% gain in industry-wide kwhr sales was the smallest since 1946. For 1959, *Electrical World* expects the industry to snap back with a big 9% increase. This may seem optimistic, but it is actually a bit conservative for a year of recovery from a recession. In 1950, the industry bounced back from the '49 dip with a 12.9% increase. In 1955, the growth in sales over '54 was 17.0% . . . For more details, see below.

**1** The recession cut industrial kwhr sales in 1958 8 billion below the '57 record. But sales per point of the FRB index rose from 1,977 million kwhr in '57 to 2,052 million kwhr in '58. This is because a greater proportion of work was done by the best machines available, which tend to be most highly electrified. With industrial production due to hit 147 in 1959. Industrial sales should reach at least 300 billion kwhr—a 9% rise.

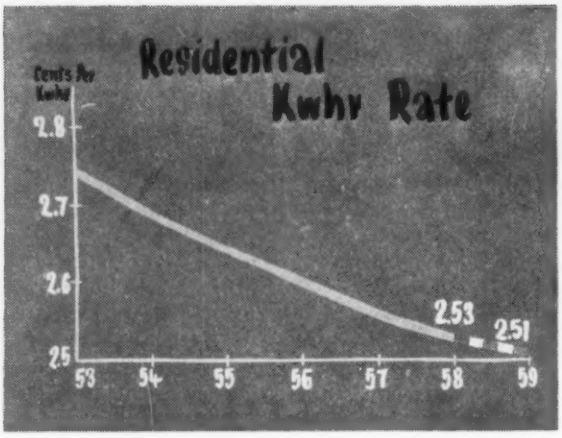



**2** Kwhr sales to commercial establishments showed a good gain during last year's recession, though not quite up to EW's forecast. For 1959 the expected 7.9% increase over 1958 will come close to the percentage gains registered in 1956 and 1957. This year's growth in commercial kwhr sales will come largely from increased air conditioning load, improved lighting, and continued expansion of suburban shopping centers.



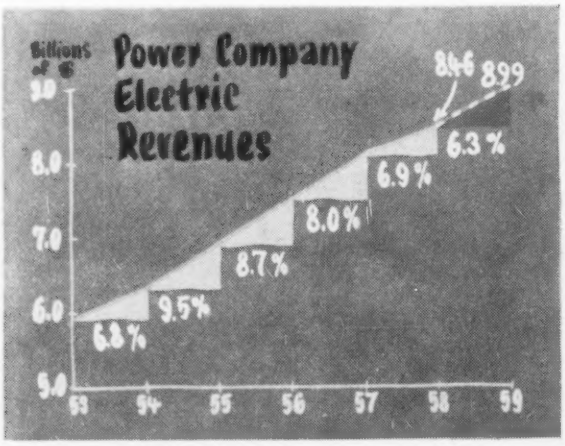



**3** Strongest sector of kwhr sales in 1958 was the residential. EW hit its forecast 8.8% increase in residential sales on the head last year. For 1959, residential sales should continue to show great strength—probably rising by about 10% over last year. Reasons include the expected addition of some 850,000 new customers this year, a long-overdue pickup in appliance sales, and further gains for electric house heating. Resistance heating installations should increase by about 9% and heat pumps by about 10%; and with the utilities aggressively promoting this most promising of all residential load builders these predictions could fall far short.

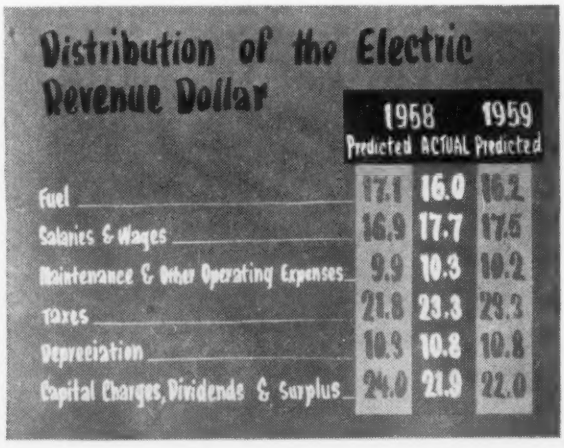


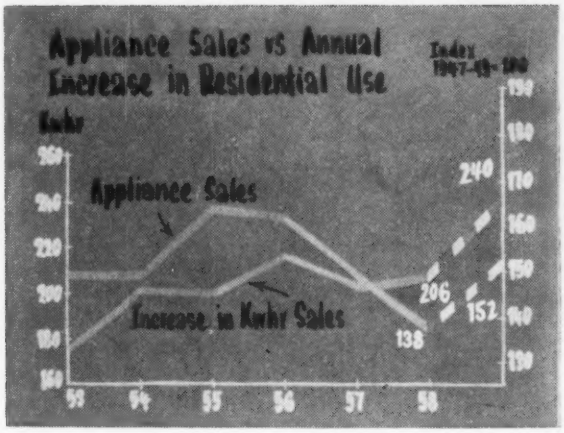

**4** The average rate per kwhr for residential service is beginning to level out. EW's 2.53¢ estimate for 1958 turned out to be exactly right. The rate is expected to drop to 2.51¢ in 1959—the smallest reduction in any year on record. The power companies alone show their average rate around 2.6¢. This may go still lower because of the number of companies promoting electric house heating and putting in a bottom rate of between 1.5¢ and 2¢ per kwhr in the residential classification. The average residential electric bill, meanwhile, hit $85.20 in 1958—the highest ever—based on record average residential use of 3,380 kwhr per customer.

**7** Although kwhr sales increased only 2.2% in 1958, power companies' electric revenues were up 6.9%. Rate increases are beginning to do some good. EW's estimated $100 million in rate hikes for 1958 overshot the mark. Nevertheless, power companies were able to add $76 million a year—an amount which was exceeded only in 1952 when the companies added $76.7 million a year in rate increases. This year began with $92 million in rate increases pending. With more increases—possibly $100 million a year—due to be put into effect in 1959, along with a 9% increase in kwhr sales, revenues should come close to $9 billion this year.

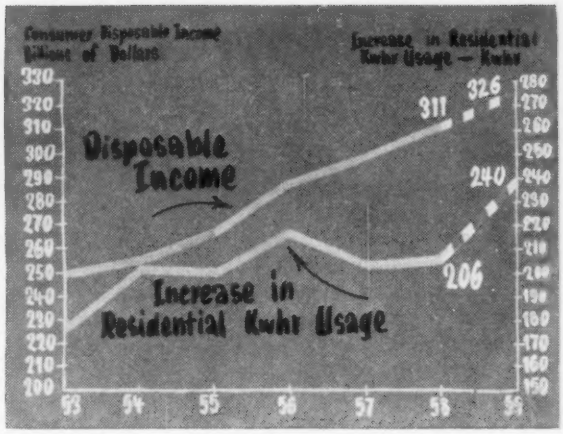



**8** EW's 1958 predictions on the breakdown of the electric revenue dollar were too high on fuel and on capital charges, dividends, and surplus. They fell short on salaries and wages, taxes, depreciation, maintenance and other operating expenses. Biggest change from 1957 to 1958 was in fuel expense, which fell from $1.365 billion to $1.350 billion. Reasons: fuel prices (particularly for residual oil) were lower, water conditions were better, and the utilities added a record amount of new steam generating equipment last year, which enabled them to shut down some older, higher-cost plants. This year's distribution should run very close to 1958's.



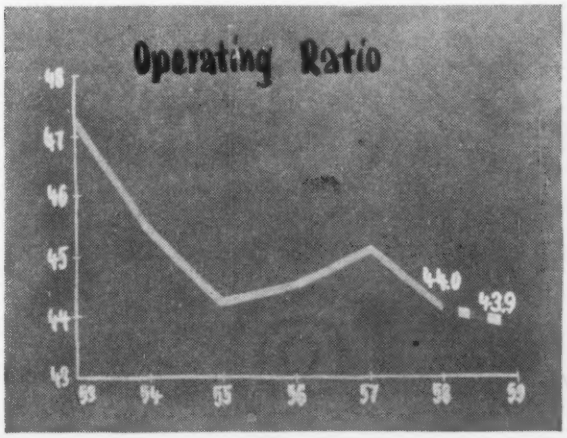



**5** One encouraging sign to emerge from the recession was the fact that average residential kwhr use continued to rise in 1958 at the same rate as in 1957, even though appliance sales fell substantially. EW had predicted an upturn in appliance sales for '58, accompanied by a 216-kwhr gain in average use. The appliance upturn failed to materialize, but residential use chalked up a 206-kwhr gain anyway. For 1959, the larger stock of over-age appliances in American homes and the fact that many families have reduced their installment debt indicate a good rise in appliance sales. This should be accompanied by an even better rise in average kwhr use.

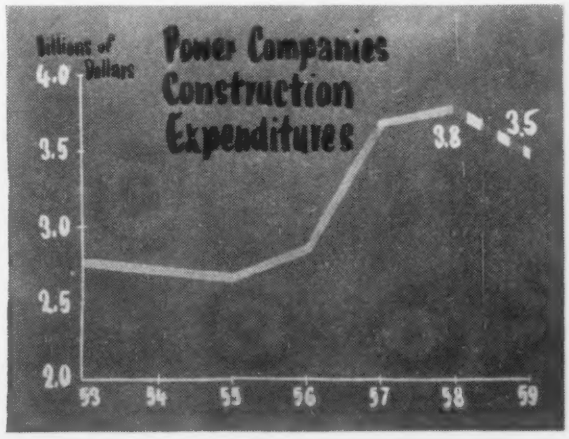



**6** With appliance sales expected to pick up, the increase in average residential kwhr use should be about 240 in 1959. This would help close the gap between it and disposable income. Last year, total consumers' personal income stayed high in spite of the recession, exceeding EW's estimate by about $2 billion. Consumer spending also remained high. However, the biggest jumps in spending were for services and non-durable goods, while hard goods such as automobiles and appliances took it on the chin. This year consumers will have some $15 billion more income after taxes, and a considerably larger amount of it should go for durable goods.

**9** As expected, the power companies' operating ratio (fuel, salaries and wages, maintenance and other operating expenses not including depreciation expressed as a percentage of total electric revenues) turned slightly downward in 1958, coming to 44.0. This was close to the EW estimate of 43.9. Better water conditions and the record amount of efficient new generating capacity helped reduce the ratio from its 1957 level of 45.1. In the future, operating ratio will tend to level off in the vicinity of 44. With less capacity scheduled to be added in 1959, the ratio will probably show little change from its '58 level. EW estimates it will be 43.9.




**10** Investor owned electric utilities plan to spend 8% less on new construction this year than they did last year. $1.6 billion will go for new generating facilities compared with $1.9 billion in 1958. Transmission expenditures are expected to be up 1.5% to $617 million, and distribution spending is slated for a 5.6% increase to $1.2 billion. However, bear in mind that these plans were firmed up last fall, and the progress of recovery since then has been more rapid than was generally expected. If recovery continues at its present pace, some increases in construction spending above the budgeted figures is not at all unlikely.



**TEN ELECTRIC COMPANIES ADDING THE GREATEST PERCENTAGE OF GENERATING CAPACITY 1959 to 1961**
(Base Date Dec. 31, 1958)

| | |
|---|---|
| California Oregon Power Co. | 129.5% |
| Missouri Public Service Co. | 118.2 |
| Washington Water Power Co. | 112.8 |
| Central Hudson Gas & Electric Corp. | 77.1 |
| Northern Indiana Public Service Co. | 75.6 |
| Southern Nevada Power Co. | 70.2 |
| Kansas Gas & Electric Co. | 65.2 |
| Houston Lighting & Power Co. | 64.0 |
| Gulf States Utilities Co. | 62.4 |
| Puget Sound Power & Light Co. | 59.7 |

**11** California-Oregon Power Co leads the parade in percentage increase in capacity scheduled from 1959 to 1961. Close behind come Missouri Public Service Co and Washington Water Power Co. Of the three, California-Oregon Power is the only one not in last year's top ten. Although it does not appear on the chart, a truly remarkable jump in capacity is scheduled for Holyoke Power Co, of Holyoke, Mass. This company's increase will be 200.5% in 1960 when it adds a 137,000-kw steam unit to its lines. Actually the company will use only part of this capability, and will sell the remainder to New England Power Co and Western Massachusetts Electric Co.

**New Capacity Additions ELECTRIC COMPANIES**

| REGION | CAPACITY Dec 31, 1958 | TOTAL ADDITIONS 1959-61 | % INCREASE |
|---|---|---|---|
| NEW ENGLAND | 5,614,755 | 1,094,100 | 19.5 |
| MIDDLE ATLANTIC | 21,411,513 | 4,878,880 | 22.8 |
| EAST NORTH CENTRAL | 25,289,666 | 5,797,450 | 22.9 |
| WEST NORTH CENTRAL | 7,179,786 | 1,687,900 | 23.5 |
| SOUTH ATLANTIC | 16,972,986 | 4,352,410 | 25.6 |
| EAST SOUTH CENTRAL | 2,592,160 | 1,486,000 | 41.4 |
| WEST SOUTH CENTRAL | 10,831,844 | 4,361,250 | 40.3 |
| MOUNTAIN | 3,597,770 | 933,000 | 25.9 |
| PACIFIC | 11,117,590 | 3,129,500 | 28.1 |
| TOTAL | 105,608,070 | 27,720,410 | 26.2 |

**12** The East South Central and West South Central Regions continue to set a brisk pace for growth, entering the 1959 to 1961 period with the expectation of adding more than 40% to their capacity. It cannot be overlooked, however, that the Middle Atlantic, East North Central, and South Atlantic Regions—while they are growing at a slower percentage rate—are adding more than half of the kilowatts expected for the entire U. S. during the period. Total additions for the 1959-1961 period were well below those for 1958-1960 with only the West North Central and East South Central Regions showing more capacity scheduled for 1959-1961.

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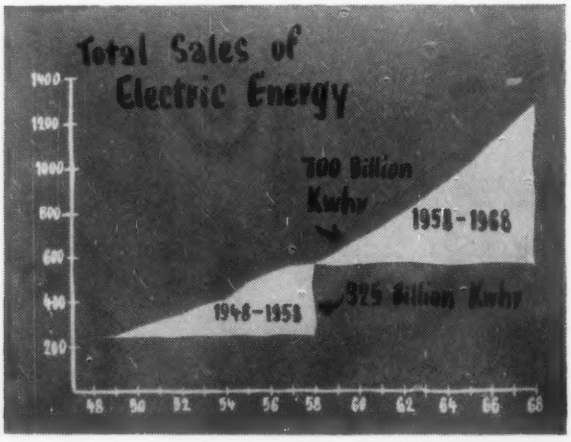
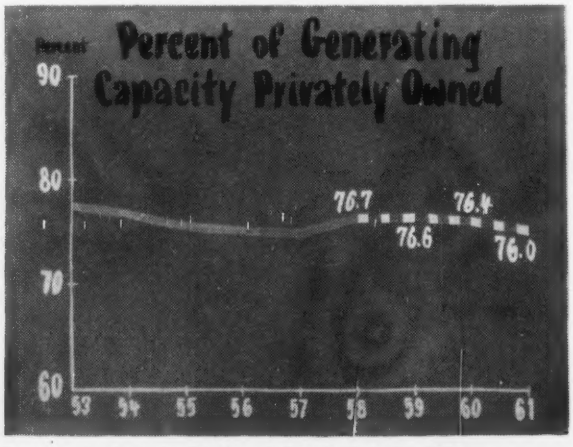
**13** For the long term, total sales of electric energy are expected to rise by about 230% in the next ten years —just the same percentage as in the past ten—a growth rate doubling every eight years. In industrial sales, the utilities can gain almost 300 billion kwhr in the next decade, as compared with half this amount in the past ten years. Commercial sales could climb by 145 billion kwhr. Residential sales could grow by 236 billion kwhr in the next decade. This assumes addition of 13 million new customers, 1,500 kwhr per existing home in appliance load, plus 5 million electric heating and cooling customers by 1958.

**14** One ominous note for the future is struck by the percentage of generating capacity privately owned. While investor-owned power companies will have installed 28 million kw of capacity by 1961, federal and public power will have installed 10 million kw. Compared with other power suppliers, the power companies will then have 76% of the country's generating capacity. But this has dropped from 85% in 1941, and the trend is still down. New trends: communities on TVA's fringe have been flirting with federal power supply; co-ops are more active; but some co-ops and municipals have been bought by power companies.




This article adapted from an address before New York Society of Security Analysts by Fischer S. Black, Feb. 11, 1959.

# Westinghouse builds world's ten largest tandem-compound turbine-generator units

The challenge to America's electric utilities has grown through the years to the point where the builders of power generation equipment must find the answers not only to today's load growth problems, but to those of the years ahead as well.

As the capacities of turbine-generator units have had to increase, so has the complexity of the machines. Building larger, more economical equipment has become the index of a manufacturer's research and engineering ability.

In answer to this challenge, Westinghouse is again proving its leadership in the field by designing and building the most powerful tandem-compound turbine-generators the world has ever known—units capable of producing as much as 325mw! Two of these 3600-rpm tandem-compound units are now in service, each with a capacity of 250mw. Eight more are shipped or on order, with ratings of 250, 275, and 325mw.

YOU CAN BE SURE...IF IT'S **Westinghouse**

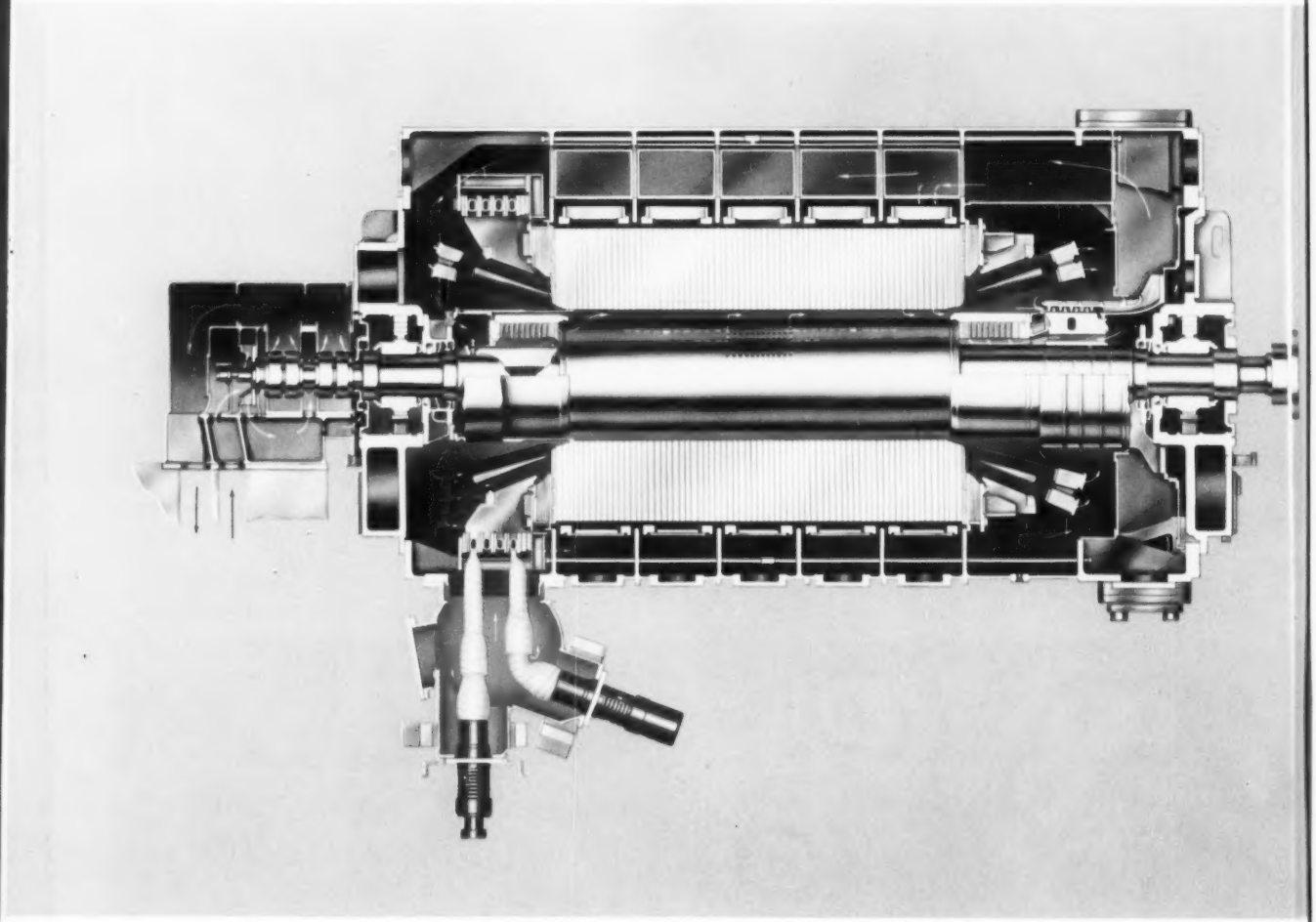
WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

HELPING YOU TO MEET TOMORROW'S LOAD GROWTH NEEDS . . .

# Westinghouse engineering and research have made these tremendous capacities practical, efficient

In 1934, when Westinghouse built the first large 3600-rpm single-shaft turbine, there began a revolution in turbine and generator design which today permits the building of gas-cooled generators in ratings of over a half million kva in a single 3600-rpm unit.

Two advances were responsible for such high-capacity generating equipment—Inner-Cooling and Thermalastic insulation.



YOU CAN BE SURE...IF IT'S Westinghouse

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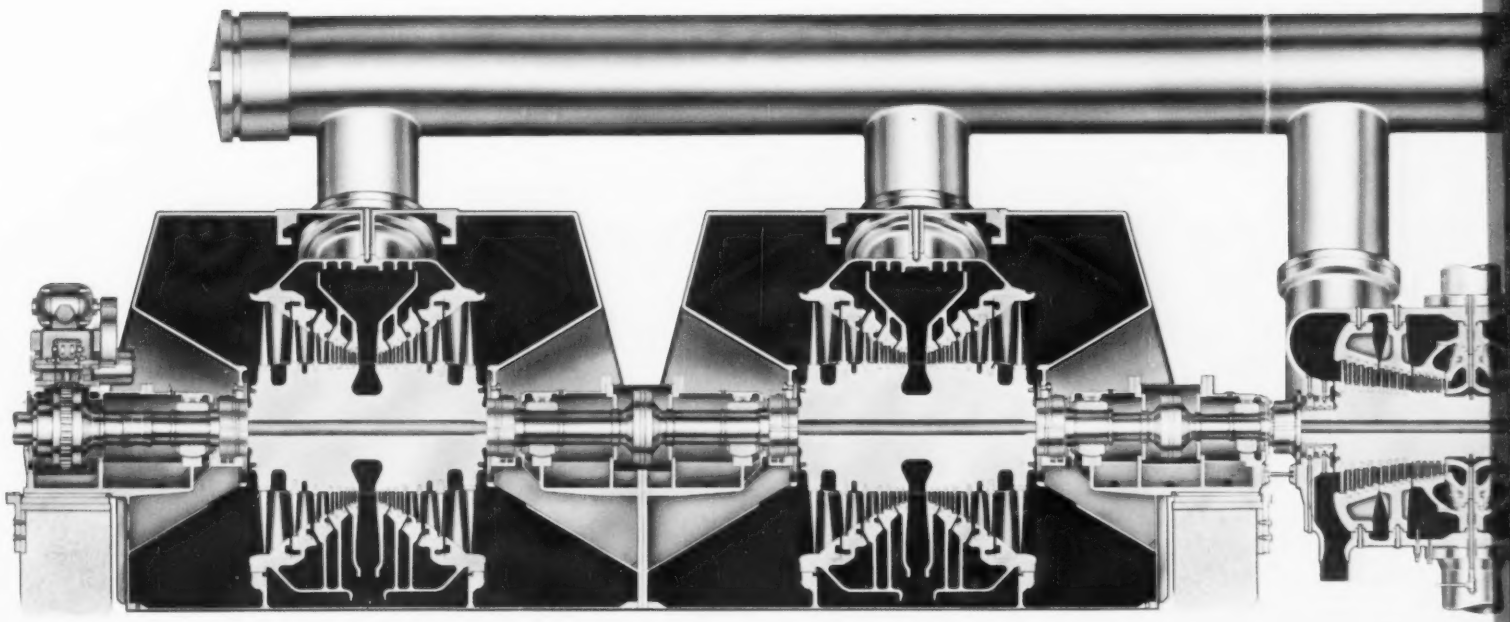
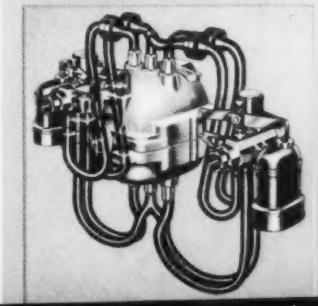


FROM RESEARCH LABORATORY TO POWER STATION . . .

# These exclusive Westinghouse "firsts" are now standard features of the world's largest tandem-compound turbine-generators

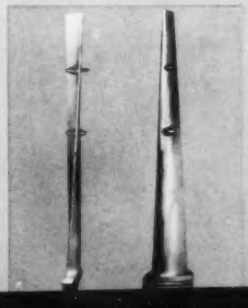
The results of W
the above 325-mw
Below are out
most advanced tu
in ability to meet

*Two Separate Steam Chests:* Simplifies turbine casing and steam chest construction, minimizes thermal stresses and permits inherently stronger pressure containers. The two chests, located at the sides of the casing, are connected to the casing only by flexible pipes and permit complete functional testing without excessive load reduction.

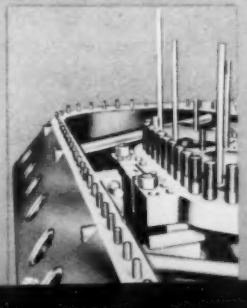


*Side Entry Roots in High-Pressure Element:* This is the highest strength fastening yet developed.

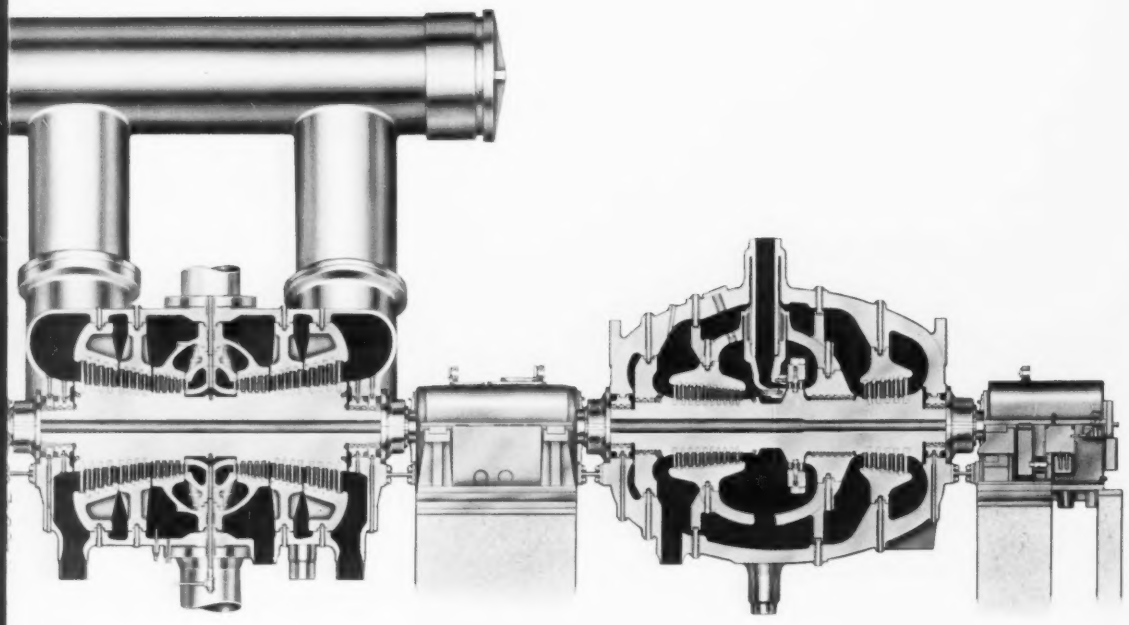
*Side Entry Roots in Low-Pressure Element:* The curved side entry fastening provides great strength and transverse and longitudinal rigidity.



*Stationary Blade Ring Supports in Low-Pressure Element:* Designed to expand concentrically with the rotor without imposing stress on the casing. The outer casing is subjected only to vacuum temperature.



*New Type of Blade Root in Intermediate Pressure Element:* Side entry fastenings similar to those in the high- and low-pressure elements are used effectively in highly stressed areas.

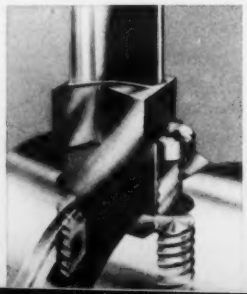


The results of Westinghouse research and engineering are embodied in the above 325-mw, 3600-rpm reheat turbine.

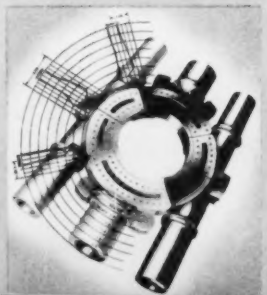
Below are outlined but a few of the typical features of the industry's most advanced turbine-generators—features which put them years ahead in ability to meet demand with maximum economy and efficiency.

*New Type of Blade Root in Intermediate Pressure Element:* Side entry fastenings similar to those in the high- and low-pressure elements are used effectively in highly stressed areas.

*New Blade Locking Device in Intermediate Pressure Element:* For single and double tee root blades, a new last blade locking device greatly reduces rotor stress.



***Separate Nozzle Chamber Construction:*** **This design advance minimizes thermal stresses. The chambers are welded to the inner casing by flexible sleeves, allowing them to expand and contract independently of both the casing and of each other.**



*Mass Flow Cooling:* Permits the insulating and cooling effect of steam to limit temperature gradients and to control the temperature at which various parts of the turbine operate. Minimum wall thicknesses and bolt sizes provide maximum reliability and minimum maintenance.

*Acceleration-Responsive Governor — the Accelerometer:* An auxiliary governor which gives instant response independently of rotor speed. This response is based on acceleration, replacing the older speed-responsive governor. With the large capability-inertia ratio of 3600-rpm tubine-generator units, the use of such a highly sensitive governor protects the unit from dangerous overspeed should the electrical load be lost.

FOLD OUT

## INNER-COOLING

The Westinghouse-pioneered Inner-Cooling system has made it possible to circulate hydrogen through the inside of the rotor and stator windings, providing intimate contact with the conductors where the heat originates. It is by far the simplest and most effective method of cooling ever devised. Already proved in extensive service, Inner-Cooling has doubled single-shaft ratings over conventionally cooled units, and it has greatly reduced the size and weight of equipment.

## THERMALASTIC® INSULATION

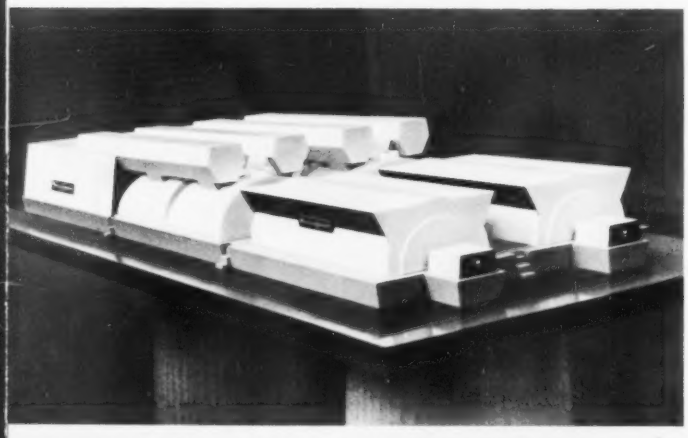
Thermalastic insulation, known as the "insulation with a memory," has a unique molecular structure which permits expansion and contraction of the windings without injurious deformation throughout the life of the machine. Voltage endurance tests prove that Thermalastic insulation has a one thousand-to-one advantage. Operating voltages cannot get through the fish-scale barrier of large mica splittings, which are locked in a memory-type elastic bond.

These important steps to greater generating capacity are paving the way to the ratings needed to meet future load growth with the greatest possible efficiency and economy

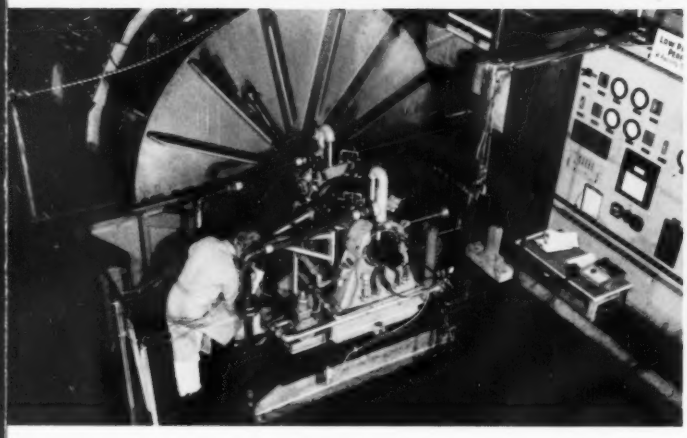
THROUGH PLOWBACK OF EARNINGS . . .

# research in action . . . the turbine of 1970 is a laboratory reality!

In the Steam Division's Development Laboratory, Westinghouse is uncovering the answers to questions of the future before a need becomes an emergency! A new peak of efficiency for the 1970 turbine, model shown below, will be assured by steps being taken now, and over the next 12 years.



Development engineers are now evaluating a new Westinghouse alloy that may be the metal of the future. For example, at 1200°F, the tensile strength is a phenomenal 100,000 psi. Damping characteristics are also excellent. After exhaustive tests, Nivco alloy will become another Westinghouse "first."



Another major development project revolves around a unique L-P turbine test facility. Westinghouse engineers are using this $1,000,000 test tool on numerous combinations of new designs, recording the performance of low-pressure components under varying conditions.

One giant stride is being accomplished in the 325-mw supercritical turbine now being built. This unit will be the world's most efficient turbine and will use the highest temperature and pressure steam in history—5000 psi at 1200°F.

These and many more Westinghouse developments —some already accomplished and more yet to come—are your assurance of the best in research and engineering quality. They are your assurance of a better electrical future. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

JI-50606

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

Ask your Westinghouse representative about the new turbine-generator film, "What It Takes."

# Reddy Kilowatt Is 25 Years Old

Reddy Kilowatt—the little man with the lightning flash for a body, a light bulb for a nose and an electric socket for an ear—is celebrating his 25th anniversary as a symbol for the electric utility industry.

He was originally conceived in 1926 when his creator, Ashton B. Collins, then merchandising manager for the Alabama Power Co, was looking out of his office window. At the time he was searching for a symbol to indicate that electricity is a servant of the people.

Then lightning struck—literally and figuratively. Collins drew the four-pronged flash on a piece of paper, added the head, shoes and gloves. The rubber shoes and gloves symbolize the idea of safety.

But the symbol remained just an idea until 1934 when the Philadelphia Electric Co was looking for something to humanize the public relations aspect of the industry. Collins offered them Reddy Kilowatt. Pennsylvania Power & Light adopted it next in April, 1934. Today over 200 utilities in this country, 18 in Canada, and 20 foreign use the symbol in their advertising, on promotional literature, and on customer bills. Collins estimates that Reddy Kilowatt serves between 30 and 40 million homes.

To mark the silver anniversary, Philadelphia Electric was honored at a recent luncheon as the first utility to use the trademark and received a plaque commemorating the event. In the photo, R. G. Rincliffe, company president, (left) receives the plaque from Collins. At the same time, Reddy Kilowatt was made a member of the 25-year club of Philadelphia Electric employees. Collins presented a silver tray to the company and a trophy to the employees.

"Reddy Kilowatt has outgrown one man," Collins says, "but I'm proud I was able to start something which has become national and international." From a staff of one, Reddy Kilowatt has grown to 23, to act as a clearing house for all companies using the symbol, to supervise all ideas proposed by these companies, and to handle the production and dissemination of the Reddy Kilowatt symbol.

And it's quite a reputation. Over the years Reddy Kilowatt has been used to influence voters in a battle against public power, as a sales message to customers on bills (Sample:

(*Continued on page* 108)

ONE MAN CAN MEASURE FASTER, MORE ACCURATELY

WITH A *Rolatape* MEASURING WHEEL

Take all your outdoor measurements this modern, time saving way. ROLATAPE reduces the risk of human error, since it records precise measurements in feet as it is rolled along—automatically and in full view of the operator. Sturdy, lightweight; equipped with automatic brake and built-in stand. Handle folds compactly.

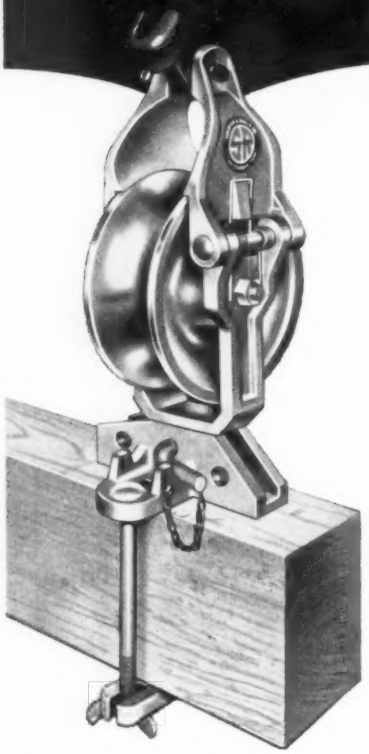
**Send Today for Full Details**

ROLATAPE, Inc.
1741 14th St., Dept. EW-2
Santa Monica, California

Send me free details on ROLATAPE

NAME .....
FIRM .....
ADDRESS .....
CITY, STATE .....

**S&R Universal Stringing Sheave**
MODEL XS-100



**USE** on CROSSARM as shown

**USE** on ANGLE for cornering block

**USE** without BRACKET to suspend from insulator stringing

Light weight, adjustable bracket, tough aluminum alloy throughout, safety locking, wide throat and anti-friction bearings. Grooved for cable through 1 ¾" diameter. Designed especially for ACSR.

*NEW CATALOG*
on complete line of S&R Conductor Stringing Equipment sent on request.

**SHERMAN & REILLY, INC.**
ENGINEERS AND MANUFACTURERS
CHATTANOOGA 2, TENNESSEE
Telephone AMherst 7-1273
TWX CT-7036


## Reddy's 25th Anniversary

(*Continued from page* 107)

"I worked all these hours for just this much pay"); as a soft approach to collect over-due bills, ("Dear Boss, have you forgotten my wages of $—— which were coming to me? I'm sure you don't want me to work without pay, so won't you please send the money right away.") and to help win rate cases, ("I'm requesting an increase in pay that will raise my wages in your home an average of about 60 cents a month —the cost of a movie ticket.")

Children write love letters to him, or stand in front of sockets and ask him to come out; adults write glowing praises of what he has done for them in the many ways they use electricity; and tough industrial customers call when their power fails and ask how soon Reddy Kilowatt will be back to work.

And whenever they speak of Reddy Kilowatt they're referring to one man—Mr. Reddy Kilowatt, Ash Collins.

## Transformers Outdo Guides

(*Continued from page* 71)

useful life is still left in the insulation in this condition.

Examination of transformers that were still in operating condition after being subjected to very heavy overloads during endurance tests showed the insulation to be intact even though the mechanical strength was practically zero. Insulating tapes and layer insulation later fell apart when attempts were made to remove pieces for examination. This could easily account for a difference in life of 10 or 100 to 1 for any given temperature.

It is no surprise, then, that modern distribution transformers with film-type turn insulation, kraft paper insulation for layers and winding forms, well dried under improved vacuum-filling facilities, filled with dry inhibited oil, and properly sealed to prevent entrance of moisture and air, should give better performance than older types. Photos on pages 70 and 71 show relative condition of interiors of modern and older transformer.

Studies have been made recently by various investigators as to the

(*Continued on page* 109)

**LABORATORY CONTROLLED...**
**Crapo**

**GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE**

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

**Heavy, uniform, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide maximum resistance to corrosion.**

*Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."*

**INDIANA**
**STEEL & WIRE CO., INC., Muncie, Indiana**

## Transformers Outdo Guides

(*Continued from page* 108)

merits of using chemical additives to reduce the thermal aging rate of cellulosic materials in transformers with the belief that this would permit operation at even higher temperatures or for longer durations. Many additives will reduce the thermal degradation rate of cellulosic materials. Not all of these additives are suitable for use in transformers, however, because of some undesirable effects on other components such as conductor enamel, iron, copper, oil, etc. Considerable testing is necessary to assure that these compounds are compatible with other transformer materials; otherwise, improvements expected in one characteristic may be offset by undesirable effects on other components.

The only real answer can come from simulated life evaluation tests of various insulation systems, including different combinations of iron, copper, oil, conductor enamel and cellulosic insulation, both treated and untreated.

Ability of distribution transformers to withstand high overloads without serious reduction in life expectancy does not necessarily offer utility companies an easy answer for their transformer application problems. Because of the higher load losses and larger voltage drops associated with high transformer overloads, loading studies and operating experiences indicate that the economics of operation rather than thermal aging consideration usually limit the peak loading level on pole type transformers.

The design technology and the production practices of modern pole-type transformers have departed so far from conditions existing when the ASA guide for loading transformers was established that the guide is presently of little use to user or manufacturer.

It appears that serious consideration should be given to establishing new loading guides, specifically for distribution transformers, which would reflect the economics of distribution systems and more realistically indicate the needs of the users already being satisfied by the electrical manufacturing industry.

You can be sure when you install
Life Span
Western Red Cedar Poles!
. . . even where the most severe decay conditions exist
LIFE-SPAN'S thermal top-to-butt treatment permeates the ENTIRE sapwood . . . assuring longer pole-line service regardless of adverse installation or weather conditions. Besides being completely immune to decay, LIFE-SPAN Poles are clean, safe to climb and are carefully selected for uniformity and quality.
Want added years of pole-line service at far less per annum costs? Specify LIFE-SPAN Western Red Cedar Poles when you buy.
A
B
C
Actual laboratory tests prove . . . pentachlorophenal permeates both inner sapwood and outer sapwood the LIFE-SPAN way, making it impossible for the entire sapwood to decay under the most severe conditions. The above is a section taken from a Western Red Cedar pole after years of actual pole-line service under adverse conditions. It shows (A) the outer sapwood, (B) the inner sapwood and (C) the heart wood — all in perfect condition.
PAGE & HILL, Inc.
Minneapolis 3, Minnesota
Life Span

# AS TULANE GROWS...

# G&W PROVIDES ECONOMICAL

*Campus scene—Tulane University*

*New main substation consists of two G&W Uniclad units. The large unit is the power center which houses a 15 kv, 400 ampere sectionalizing load break oil switch and eight three-phase power fuse taps. Facing it at left is the metering unit which houses a 15 kv, 400 ampere dual feeder load break oil switch and metering compartment.*

Please send me your folder on the Tulane University installation.

Name_____

Position_____

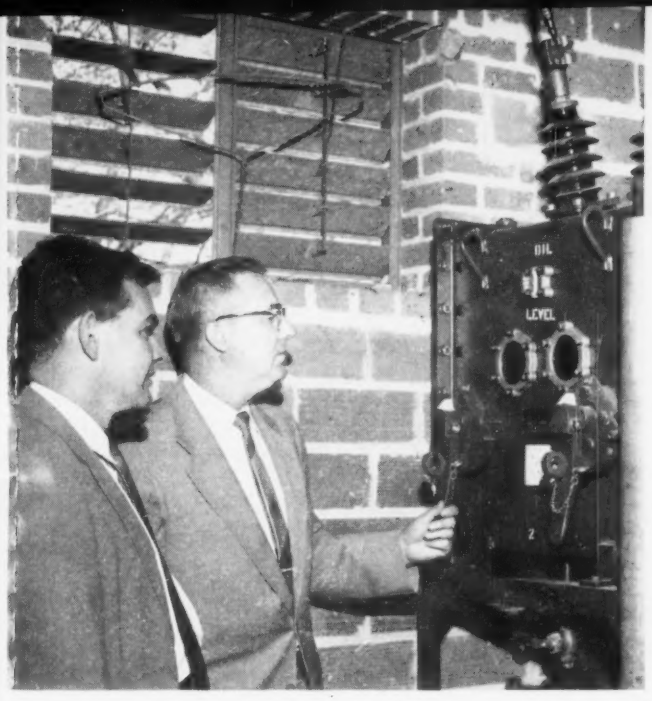
Company_____

Address_____

City_____ Zone_____ State_____

**FREE FOLDER** tells how Tulane achieved flexibility and economy in its new electrical distribution system. Contains informative data for future reference.

**SEND FOR IT TODAY!**




*Contributing to this project were G&W representative, W. P. Dillon; Director of Physical Plant Maintenance at Tulane, G. Johnson; consultants were W. King and R. C. Morgan IV of Design Engineers and Associates; I. Isaacson, Jr. of Weil and Moses; A. Pincus of Mario Zerrigon and Associates and Joseph E. Leininger and Associates. The electrical contractors were Lindsey and Morgan, Gibson and Odom, Busy Electric, and Nola Electric.*

*G&W "RAL" sectionalizing switch installed in transformer vault. Loop feeders go to the switch to serve the load transformer. Feeders, switch, or load can be isolated without affecting the remainder of system. Shown are William King, design engineer (left), and George Johnson, Director of Physical Plant Maintenance, Tulane.*

# MEANS OF EXPANDING

## an underground distribution system

When Tulane University's rapid growth created a need for expanding the existing 2400 volt electrical distribution system to a 13,800 volt loop system, G&W equipment scored a new high for flexibility, economy and dependability.

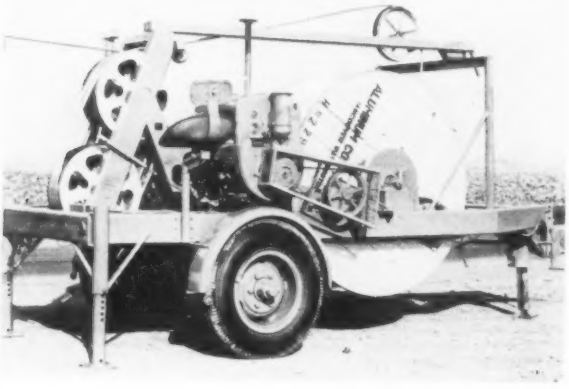
Versatile G&W equipment provides a simple, comparatively low-cost means of isolating load and circuit faults in any part of the system to avoid excessive outages.

G&W switches, fuse cutouts and Uniclads (metalclad switchgear) offer worthwhile savings. Made of standardized components, they are engineered to meet the exact requirements of the job. Assembly is simplified. Result: unexcelled distribution system economy!

G&W equipment offers many other significant advantages. Our new Tulane University folder gives the full story . . . be sure to send for it today.

*George Johnson of Tulane (left) and Alan Pincus, consulting engineer, check a G&W Load Break Oil Switch-Fuse Unit under the Tulane stadium.*

**G&W ELECTRIC SPECIALTY CO.**
3500 W. 127th St., Blue Island, Ill.
*Canadian Mfr.-Powerlite Devices, Ltd.*
*Toronto, Montreal & Vancouver*



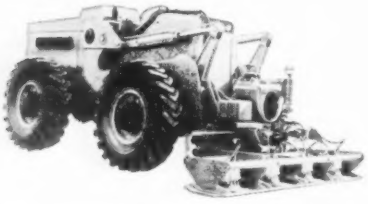
## Cable Puller . . .

**. . . is designed for distribution work.** It pulls tensions up to 1,700 lb at 3 mph, or 3,100 lb in low gear. Designated Pengo Model 5500 BWCP Bull Wheel Cable Puller, it is designed to be used with 500 Series models of Pengo Tensioners for distribution or hot line stringing. Complete unit, with 30 hp engine, pair of 26-in. dia neoprene-lined bull wheels which pull any type of pulling line up to 1¼-in. dia manila rope, carries own reel.

**Petersen Engineering Co, Inc, Santa Clara, Calif.**

## Compactor . . .

**. . . is available for all "Payloader" tractor-shovel models.** A heavy-duty, air-cooled motor and generator unit drives electric-motor vibratory units on four compactor pads. Each of the pads delivers up to 4,200 three-ton blows per minute.



The compaction unit is recommended for granular soil sub-bases; the base courses of sand, gravel, rock or slag in waterbound and penetration macadam construction.

**The Frank G. Hough Co, Libertyville, Ill.**

## Power Supply . . .

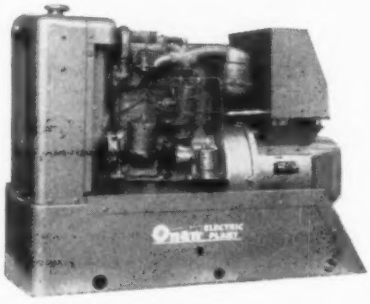
**. . . for microwave and carrier equipment** requiring interruption-free service is possible with a new 10-kw flywheel-motor-generator set coupled via magnetic clutch to an automatic-starting diesel engine. The power system is driven normally at 1,800 rpm by its induction motor powered from a utility source. The permanent magnet generator's 115/230-v output is regulated. Energy stored in the flywheel is sufficient to maintain full output after a supply power interruption while the magnetic clutch operates automatically to crank the diesel engine. Transfer tests show under 3% voltage dip and a 2.5-cps frequency disturbance in output. The governor holds frequency within ±2% during emergency operation. Restoration of utility power automatically reconnects the induction drive motor and shuts down the diesel engine, with negligible voltage and frequency disturbance. The system is intended to operate continuously as an m-g set and up to 200 hr unattended on diesel power.

**Allis Chalmers Mfg Co, Milwaukee, Wis.**

## Acetylene Detector . . .

**. . . indicates if fault has occurred in power transformer.** The detector is an elementary form of gas analyzer, which detects acetylene gas in the air space of a transformer by bubbling gas from the transformer through a solution of ammonia. Formation of a brick red precipitate indicates presence of acetylene. The equipment is able to sense faults that have lasted for as little as three cycles.

**Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.**



## Diesel Generators . . .

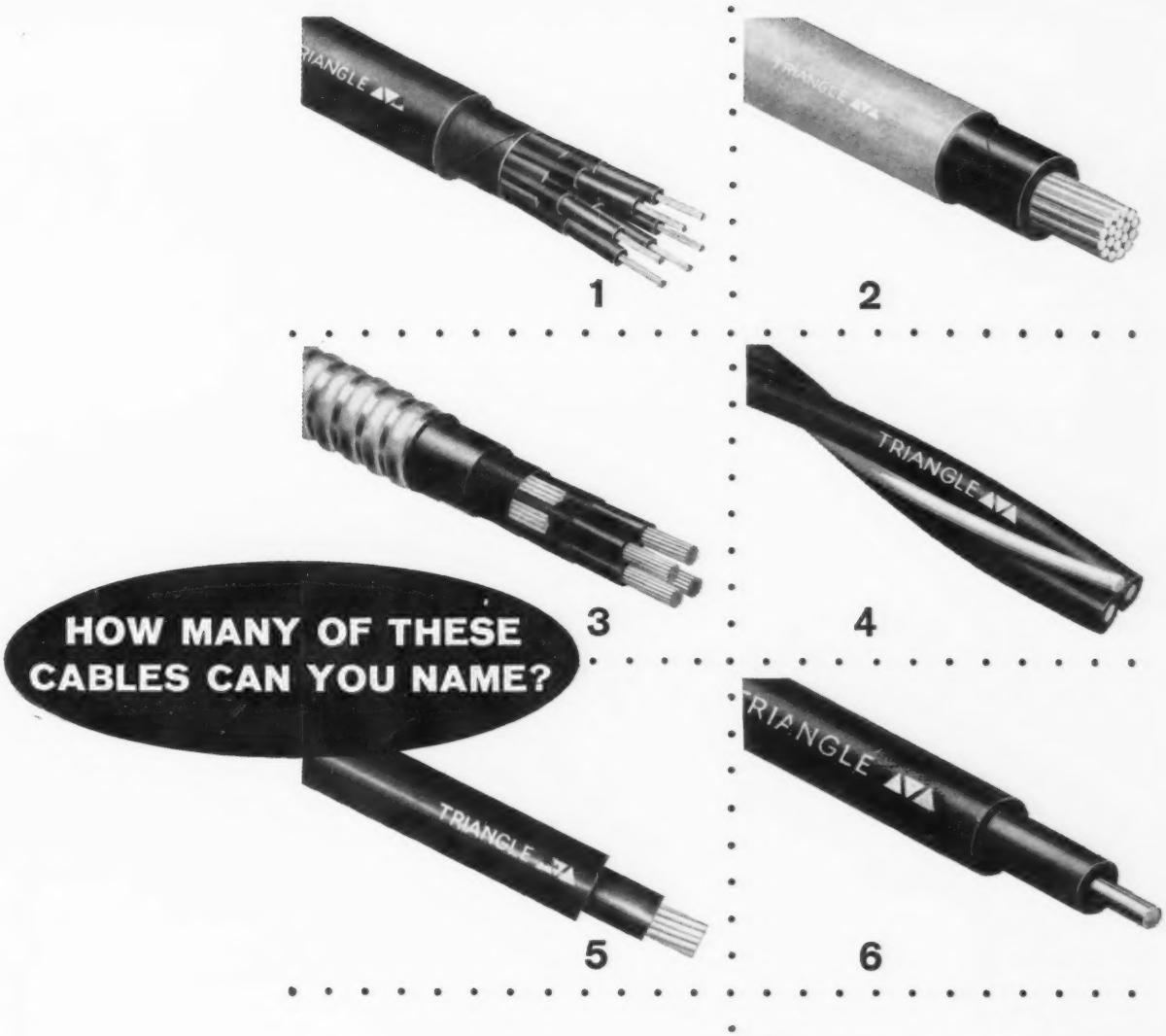
**. . . are available in 10 and 15 kw sizes** in all standard 60 and 50 cycle voltages to 460 v. Completely self-contained, the Series DZB units provide either continuous or emergency power. Both single and 3-phase models are offered.

**D. W. Onan & Sons Inc, Minneapolis, Minn.**

## Fault-Finder Alarm . . .

**. . . with solid state components** can monitor substation operations. A transistorized ring counter scanner monitors up to 20 separate items at

(*Continued on page* 114)




These six are only a few of the many types in the Triangle line of Power, Control and Lighting Cables for utilities. How many can you name without peeking at the bottom of the page?

You've probably specified these types many times — more and more utility engineers are doing that these days. They've become convinced that Triangle, a long time leader in the building wire and conduit field, can and does turn out control, network and service drop cables of the same high quality. Triangle products "must be right"—they must meet all specifications with plenty to spare.

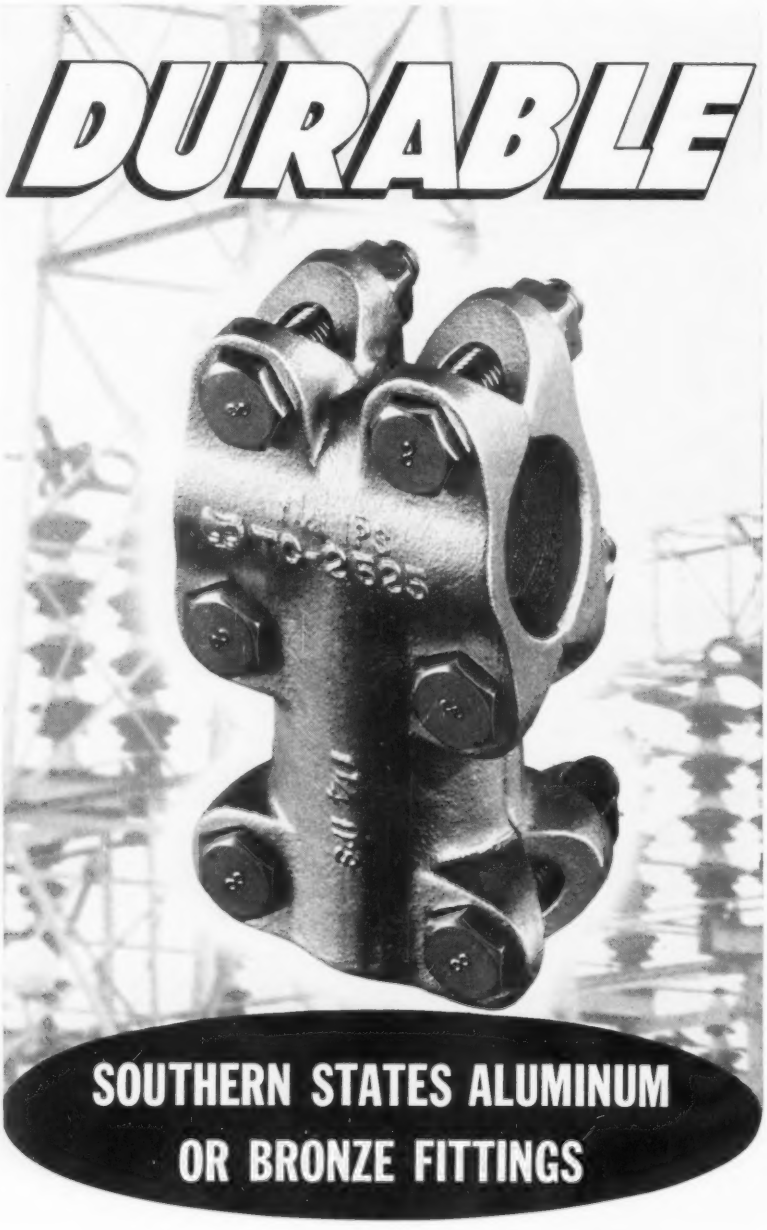
*Why don't you find out more about these and other cables in the broad Triangle line. Write for complete literature which is available to answer your specific inquiry.*

**TRIANGLE CONDUIT & CABLE CO., INC.**

**NEW BRUNSWICK, NEW JERSEY**

"It MUST Be Right!"

1 Control Cable 2 Varnished Cambric Lead Covered Power Cable 3 Interlocked Armor Power Cable 4 Neutral Supported Secondary Network Cable (Triplex) 5 RR Cable 6 Series Street Lighting Cable

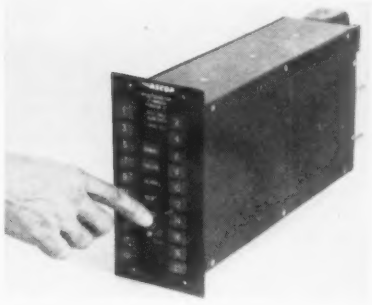



Knowing that fittings are often re-used, Southern States has designed its entire line with easy, on-the-job assembly and re-assembly foremost in mind. Southern States connectors and bus supports have recessed hexagonal bolts, assuring easy and rapid "one-wrench" installation or removal. Each connector fits properly, has ample strength, and is sufficiently rugged at stress points. *Never underestimate the importance of a good connection!*

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto


(*Continued from page* 112)



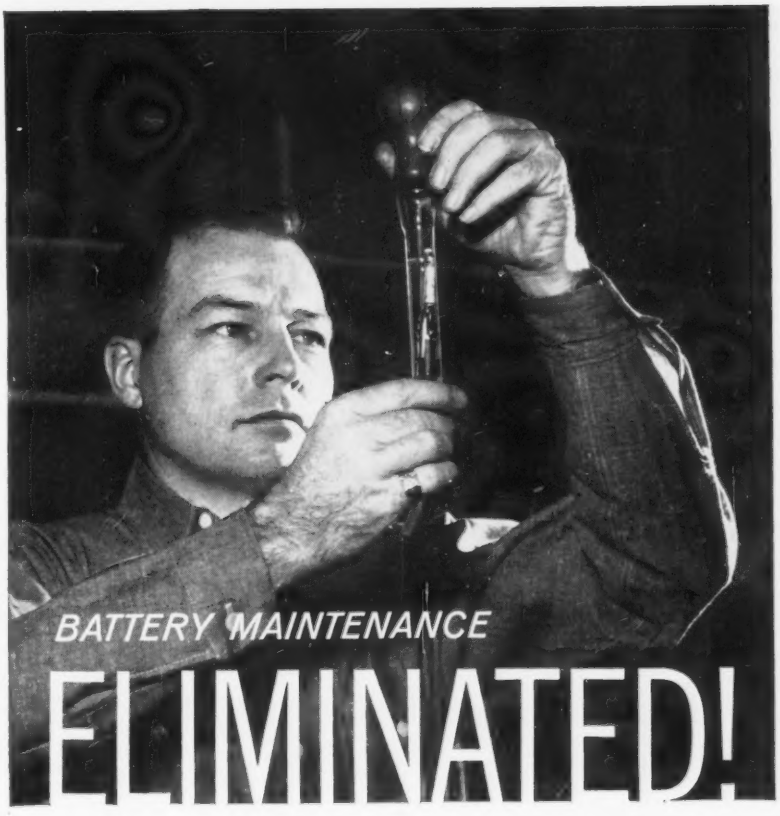
a scanning rate of 10 points per second. The Fault-Finder system requires only one communications channel, ranging from a pair of wires to a sub-carrier radio or microwave channel. The system operates from 115-v 60-cycle ac source or 125 or 48-v dc source.
**Applied Science Corp of Princeton, Box 44, Princeton, N. J.**

## Transformer . . .

**. . . permits thawing frozen pipes** by using 120-v ac service. The Porta-Thaw is equipped with a 10-ft power cable with plug and receptacle and two 20-ft thawing cables with lugs and pipe clamps. It is rated at 300 amp, 10 v on 100% duty cycle. The unit weighs 63 lb.
**Hobart Brothers Co, Hobart Square, Troy, Ohio.**

## Contact . . .

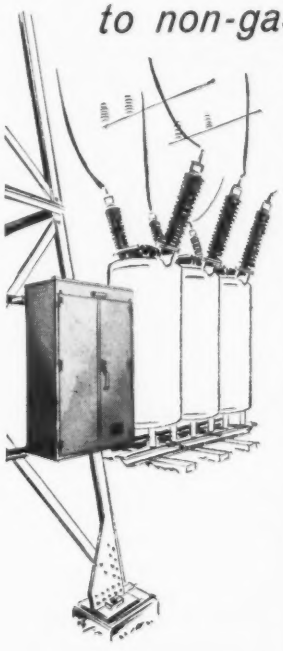
**. . . is permanently bonded to rivet or backing** up to the melting temperature of the metal. The new bonding process provides maximum strength and corrosion resistance, improves electrical and thermal conductivity, and eliminates contact surface contamination by solders.
**Contacts, Inc, 1500 Silas Deane Highway, Wethersfield, Conn.**



BATTERY MAINTENANCE

# ELIMINATED!

*You don't add water or electrolyte to non-gassing Gulton Power Units*



THINK of the savings in maintenance alone! Right now your battery installations are serviced about once a month. Your maintenance man takes an hour, probably more, to check specific gravity and cell voltage, add water—return a second time if booster charge is needed.

With Gulton Power Units—no maintenance! That's because famous Voltabloc® non-gassing *sealed* nickel cadmium batteries operate year after year *without attention.*

You also *save on real estate;* reason: the patented sintered plate construction of the Voltabloc and the compact automatic charger. Together these deliver 20 times the punch, take 1/20 the space of conventional units.

Thus you get all the power you need for closing and tripping switches, breakers, etc., in a fraction of the space needed by ordinary DC sources—entirely eliminate the need for battery rooms and high installation costs.

Find out now how Gulton Power Units are saving other companies time and money. Write for Bulletin No. GPU.

ALKALINE BATTERY DIVISION

**Gulton Industries, Inc.**

Metuchen, New Jersey

In Canada: Ward-Leonard, Toronto

Gi


# Reader Service

**For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:**

**NEW EQUIPMENT**

Petersen .....Cable Puller ☐
Hough .....Compactor ☐
Allis Chalmers.....Power Supply ☐
Westinghouse .....Detector ☐
Onan .....Generators ☐
Applied Science.....Alarm ☐
Hobart .....Transformer ☐
Contacts, Inc. .....Contact ☐

**OTHER**

Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countries or to competitive manufacturers.

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TITLE_____

DEPT._____

COMPANY_____

ADDRESS_____

FOR:

Reference ..... ☐
Specs ..... ☐
Trial ..... ☐
Purchase ..... ☐

# News About People

PROBST

## New VP Named at CL&P

Robert F. Probst, secretary of The Connecticut Light & Power Co, has been elected a vice president of the utility. He will continue in his present post.

Joining the company in 1923, he served in various capacities in the accounting department before being elected assistant secretary in 1942. He was named secretary in 1951.

A graduate of the Hartford (Conn.) College of Law, he serves on several utility association committees.

## Consumers PPD Names Barber as President

Wayne E. Barber, a Norfolk, Nebraska businessman, has been named president of Consumers Public Power District.

A member of the board since November, 1956, he was secretary in 1957 and 1st vice president in 1958.

Barber graduated from the University of South Dakota in 1936 with a major in Business Administration. A Past Exhaulted Ruler of the Veteran of Foreign Wars, and a member of the American Legion, he operates a paint store in Norfolk.

## Booth Elected President at Jackson & Moreland

BOOTH CARHART

Jackson & Moreland, Inc, consulting engineering firm, has named Ralph D. Booth president, and Frank M. Carhart chairman of the board. Hartley Rowe, chairman of the board of Jackson & Moreland International, Inc, was made assistant to the president and a member of the board of directors.

Booth joined Jackson & Moreland in 1920, became a general partner in 1930 and in 1956 was made executive vice president. Carhart joined the company in 1923 as a department manager in charge of rates, finances and other economic matters for large public utility properties. He became a member of the firm in 1927 and a general partner in 1930. He had been president since 1956.

## Southern Services Names Brownlee Power Pool Mgr.

Southern Services, Inc has appointed William R. Brownlee power pool manager, to coordinate the power supply operations of the Alabama, Georgia, Gulf, and Mississippi Power Companies, and the Southern Electric Generating Co of the Southern Company system.

Brownlee joined the operating department of the Tennessee Electric Power Co in 1929, remaining with it until 1939 when he transferred to the predecessor company of Commonwealth Associates, Inc. In 1951, he joined Southern Services as system planning engineer, holding this position until his present assignment.

## Coleman Retires as EEI Editorial Director

Wilgar Coleman, head of the editorial department at Edison Electric Institute, retired February 2 after 35 years of service with the Institute and its predecessor, the National Electric Light Assn.

Since the organization of EEI in 1933, Coleman was responsible for the editing and production of all the Institute's publications. Before joining the trade association, he worked with a railway company, an advertising agency and as a newspaper reporter and departmental editor.

Prall Culviner has succeeded Coleman as editorial director. He joined the EEI editorial department in 1948.

*What a line...*

**CF&I GALVANIZED STEEL STRAND**

Where overhead distribution lines must cover long spans, or in areas where high velocity winds and adverse weather impose a severe strain on power poles, dependable guying is a must.

To provide safe installation and long, trouble-free service life, ground crews prefer CF&I Galvanized Steel Strand. It is made of steel with exactly the right chemical and physical properties to assure high strength and easy workability. The wire is carefully drawn, stranded, cleaned and galvanized with a tightly-bonded coat of pure zinc to produce a corrosion-resistant finish that won't flake, even when severely bent.

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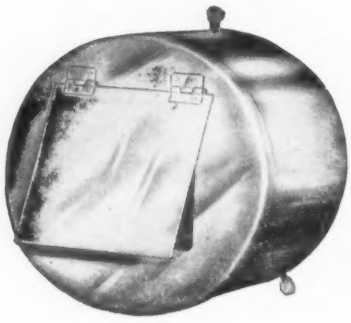

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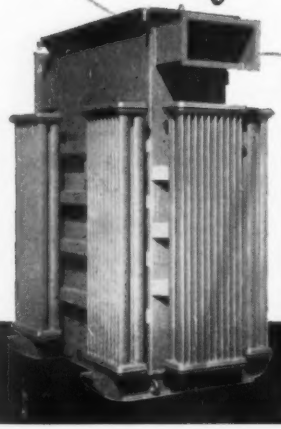

Shaw-Perkins Cooling Radiators are available in a complete range of sizes and models, to give any make and capacity of transformer all the efficiencies of thermosiphon self-cooling. They feature full length oval tubes for optimum heat dissipation, free flow. Flanges, elbows, valves, and other accessories available for any mounting condition.

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## PERSONAL BRIEFS

**E. Bruce Shuler** has been made assistant superintendent of the Transmission Lines Department of Duke Power Co. **James D. Sloan** has been appointed manager Charlotte District. **Glen A. Coan,** assistant rate engineer, has been named rate engineer succeeding **C. S. Reed,** who retired but remains as vice president and rate consultant.

**Harold Quinton,** chairman of the board of Southern California Edison Co has been elected to the National Industrial Conference Board.

**Roger Q. Scott,** manager of retail operations for Gulf Power Co has retired.

**Amthel W. Isenhart** has retired as vice president of Dayton Power & Light Co.

**W. E. Slaugher,** general auditor for Public Service Co of Oklahoma has retired.

**Daniel T. Warner,** president, and **William R. Clements,** sales vice president have retired from The Master Electric Co Division, The Reliance Electric and Engineering Co.

**Wilmot F. Wheeler, Sr.,** has retired as chairman of the board and the executive committee of the American Chain & Cable Co.

**Dr. William A. Thomas** has been named manager of corporate research and development for Square D. Co.

The Bristol Co has made **John F. Peterson** branch manager of the Newark office.

**W. Kenneth Daly** has retired as vice president and comptroller of The Anaconda Co.

**Gwilym A. Price,** chairman of the board of the Westinghouse Electric Corp is serving in his second year as chairman of the Crusade for Freedom.

**John C. Beck** has been named vice president-sales of the Bethea Co.

## A TREE TRIMMING PROBLEM SOLVED

*By spinning this three conductor cable . . . .*

The utility company that installed the distribution line in this photo had permission to go through this forest of great old evergreens, if they did not cut, trim, or damage the trees. After investigating all types of line construction they found that field spun cable was the best solution to their problem. Using cable and spinning it in the field, they were able to put up this three conductor distribution line to everyone's satisfaction, *at a cost less than any other type construction.* For information on field spun cable, write to address below.

CABLE SPINNING EQUIPMENT CO.

3100 Topeka Avenue Topeka, Kansas


**C. J. Moore** has been appointed to the newly created post of general sales and marketing manager of Exide Industrial Division, The Electric Storage Battery Co. **Thomas E. Peacock** has been named marketing manager.

**Melvin L. Manning** has become dean of engineering at South Dakota State College.

Gould-National Batteries has appointed **Harvey N. Stover** as assistant vice president for industrial sales.

**T. S. Banghart** has been named manager of switchgear sales; **James S. Holtzinger** has been named manager of application engineering; for Pennsylvania Transformer Division, McGraw-Edison Co.

## OBITUARY

**Ellis L. Phillips,** 85, former president and chairman of the board of Long Island Lighting Co died Jan. 29. He was most recently president of E. L. Phillips & Co, consulting engineers.

**W. A. Parish,** 71, chairman of the board of Houston Lighting & Power Co died Jan. 23.

**Charles Breitinger,** 71, retired official of the Philadelphia Electric Co, died recently.

**Benjamin P. Baker,** consulting engineer for the Westinghouse Electric Corp, died suddenly at the age of 60.

**Lloyd C. Bell,** manager of the Valuation and Property Record Section of the Duquesne Light Co, died recently.

**Elton G. Dunlap,** 77, retired treasurer of the Ohio Edison Co, died after a short illness.

**Walter G. Henson,** 64, superintendent of Duke Power Co, died recently.

**William J. Foster, Jr.,** a vice president of New York State Electric & Gas Corp died Jan. 18 after a short illness.


## Want a High Current Test Table?

# 150 Amperes

*Multi-Purpose*
**FORM FA TEST TABLE**

. . . for testing Watthour Meters, Graphic Instruments, Indicating Instrument, Relays, Small Transformers. Handy and versatile, here's a table that will provide 0-150 ampere loading with 0-600 volts potential. Phase Displacement is 0 to unity, or 0 to 360 degrees. May be equipped with Photo Electric Counter.

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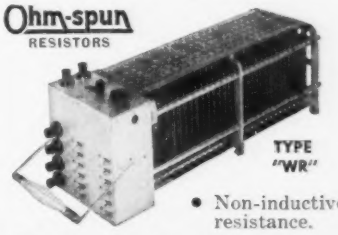
Ohm-spun RESISTORS




- Non-inductive resistance.
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- Loads are made in different capacities from 30 to 60 amperes, 120 volts and double voltage, double current.
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# Books

### How TVA Grew

***The Building of TVA***—*An Illustrated History. By John H. Kyle. Published by Louisiana State University Press, Baton Rouge, La., 162 pages. Price $7.50.*

The purpose of this book is to present the work of the Tennessee Valley Authority. It is a story in words and pictures of all the hydro dams, steam plants, and many of the bridges and incidental structures in the TVA system. In addition it gives the size, location, recorded cost and position in the system of the major TVA structures.

### Applying Air Conditioning

*Residential and Commercial Air Conditioning.* By Charles H. Burkhardt. Published by McGraw-Hill Book Co, 330 West 42nd Street, New York 36, N. Y. 300 pages, illustrated. Price $9.00.

A "how-to-do-it" guide to the planning, installation, and servicing of air conditioners. The book presents basic theories and supplies practical information for calculating heat gains, sizing the cooling system, installing the unit and its various components, and installing and operating controls.

Components are fully explained and important advances discussed in absorption cooling, air cooled condensers, water towers, and compressor and component servicing. A chart method for servicing and a specialized, step-by-step approach to the various components involved is included.

### Books Received Since November 28, 1958

*Marks' Mechanical Engineers' Handbook, Sixth Edition.* Revised by Theodore Baumeister. Published by McGraw-Hill Book Co., 330 West 42nd St, New York 36, N. Y. 2270 pages, illustrated. Price $23.50.

*3 Water Balance Maps of Eastern North America.* By C. W. Thornthwaite, John R. Mather and Douglas B. Carter. Published by Resources for the Future, Inc, 1145 Nineteenth St, Washington 6, D. C. Price $2.00.

*Residential and Commercial Air Conditioning.* By Charles H. Burkhardt. Published by McGraw-Hill Book Co., 330 West 42nd St, New York 36, N. Y. 300 pages, illustrated. Price $9.00.

# SEARCHLIGHT SECTION

(Classified Advertising)

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Send complete resume, in confidence, stating present salary and salary expected.

**P-9943** Electrical World
Class Adv. Div.,
P. O. Box 12, N. Y. 36, N. Y.

*ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.*
*NEW YORK 36: P. O. BOX 12*
*CHICAGO 11: 520 N. Michigan Ave.*
*SAN FRANCISCO 4: 68 Post St.*

### *POSITION VACANT*

**Wanted—University graduate Engineer with** at least five years experience operation steam electric generating station for responsible position in Maracaibo, Venezuela. Preference will be given Spanish speaking applicant. Salary dependent on qualifications. P-8320, Electrical World.

**Wanted—Electric Distribution Engineer with** college education and utility experience for employment in a position open with an electric utility company in southern Connecticut. Salary of $12,000.00. per year. Send resume of age and experience to P-9929, Electrical World.

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**Representative wanted for manufacturer of** street lighting equipment, pole line specialties. Full particulars RW-9821, Electrical World.

**Well established manufacturer of Street** Lighting Controls desires representation by live drummer with three feet for much leg work and a hunger for money. Territory open in: Minnesota and North Dakota; Kansas and Western Missouri; Utah; Oklahoma; Carolinas, Georgia, Alabama and Florida; Alaska; Hawaii. RW-9933, Electrical World.

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3—500 KVA W-H 13200-2300/4000Y
3—500 KVA W-H 7200-2400/4160Y
3—400 KVA W-H 11500-2400/4800
3—333 KVA W-H 67000-480
3—333 KVA W-H 2400-120/208Y
6—167 KVA G-E 7200-2400/4160Y
6—150 KVA G-E 7200-240/480
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*At Your Service . . .*

*The Searchlight Section is at your service to bring business needs or "opportunities" to the attention of men in executive, management, sales and responsible technical, engineering and operating capacities with the industry served by this publication.*

# The Meetings Calendar

## FEBRUARY

**Pennsylvania Electric Association** — Relay Committee, Hotel Pick-Roosevelt, Pittsburgh, Pa., Feb. 26-27.

**22nd Annual Upper Midwest Electrical Industry Convention**—Leamington Hotel, Minneapolis, Minn., Feb. 22-25.

**California Municipal Utilities Association**—Annual Conference, Berkeley, Calif., Feb. 24-27.

**Public Utilities Advertising Association**—Annual Regional Conference, Hotel Taft, New Haven, Conn., Feb. 26-27.

**National Wiring Sales Conference**—Jung Hotel, New Orleans, La., Feb. 26-27.

**Edison Electric Institute**—Area Development Committee, New York City, Feb. 27.

## MARCH

**Southern Safety Conference and Exposition**—Battery Park-George Vanderbilt Hotels, Asheville, N. C., March 1-3.

**Second National Lighting Exposition**—Coliseum, New York City, March 1-4.

**Industrial Electrical Exposition**—Olympic Park, Newark, N. J., March 2.

**Western Joint Computer Conference** — Fairmont Hotel, San Francisco, Calif., March 3-5.

**Joint Edison Electric Institute** Industrial Relations Committee —Personnel Administration Section, **Pennsylvania Electric Association** and **Southeastern Electric Exchange**—Mayflower Hotel, Washington, D. C., March 5-6.

**Edison Electric Institute**—Street Lighting Committee, Chicago, Ill., March 9; Industrial Power & Heating Group, Chicago, Ill., March 9; 25th Annual Sales Conference, Chicago, Ill., March 9-12; Commercial Sales Group Committees, Chicago, Ill., March 9.

**Electrical Manufacturers Exposition** — Franklin County Veteran's Memorial Building, Columbus, Ohio, March 10-12.

**National Association of Corrosion Engineers**—15th Annual Conference & Exposition, Sherman Hotel, Chicago, Ill., March 16-20.

**American Society for Metals**—11th Western Metal Exposition & Congress, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif., March 16-20.

• **Eighth Electrical Engineers' Exhibition**—London, England, March 17-21.

• **New England Home Show**—Combined trade and consumer show, Commonwealth Armory, Boston, Mass., March 18-24.

**Pennsylvania Electric Association**—Personnel Practices Committee, Philadelphia, Pa., March 18; Customer Contact Committee, Hagerstown, Md., March 19; Street & Highway Lighting Committee, Pittsburgh, Pa., March 24-25.

**Canadian Electrical Association** — Western Zone Meetings, Royal Alexandra Hotel, Winnipeg, Man., Canada, March 23-25.

**Southeastern Electric Exchange** — Annual Conference, Boca Raton Hotel & Club, Boca Raton, Fla., March 23-25.

• **Institute of Radio Engineers**—National Convention, Coliseum and Waldorf Astoria, New York City, March 23-26.

**Oklahoma Utilities Association**—Accounting Section, Mayo Hotel, Tulsa, Okla., March 25; Annual Convention, Mayo Hotel, Tulsa, Okla., March 26-27.

**Pacific Coast Electrical Association**—Engineering and Operating Conference, Hotel Lafayette, Long Beach, Calif., March 30-31.

**American Power Conference**—Sponsored by Illinois Institute of Technology, Hotel Sherman, Chicago, Ill., March 31-April 2.

• **Southwest Electric Conference**—San Marcos Hotel, Chandler, Ariz., April 5-7.

• **Fifth Nuclear Congress**—Sponsored by Engineers Joint Council, Public Auditorium, Cleveland, Ohio, April 5-10.

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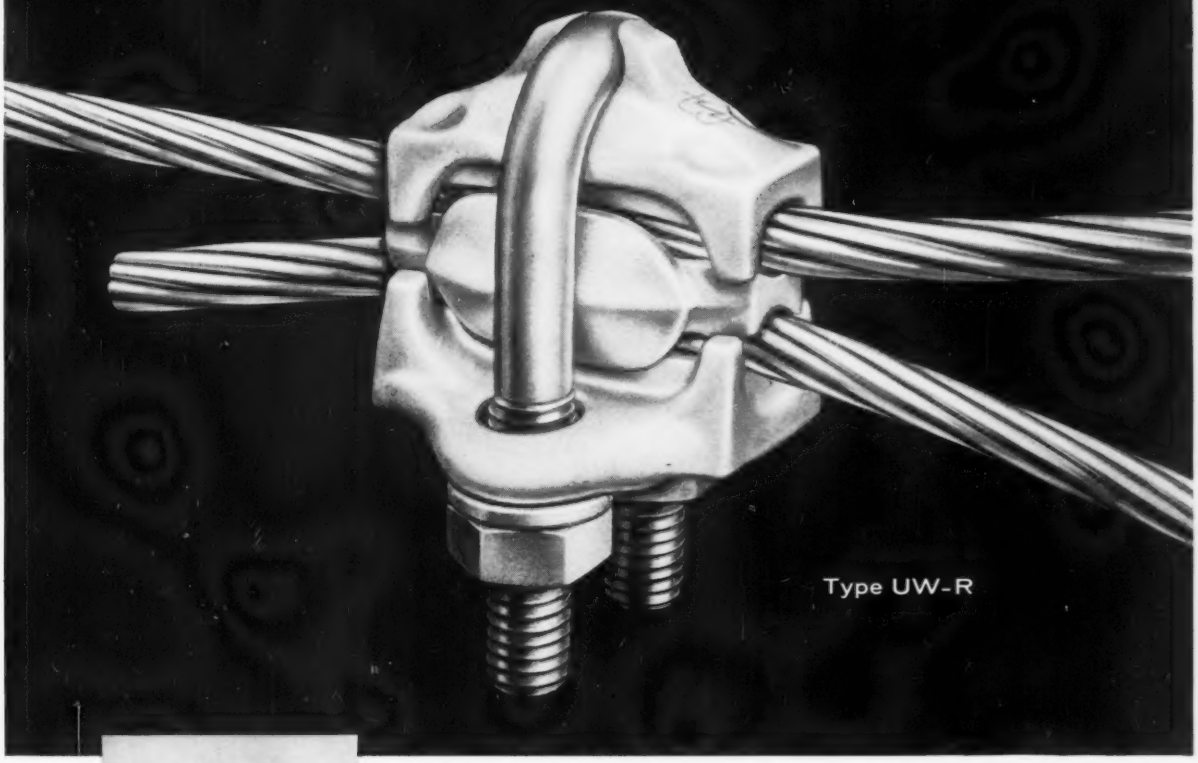
# CLIPIT

## low cost DEADEND for ACSR and Aluminum



Generous wrap-around CLIPIT spacer, coated with corrosion inhibiting compound, assures good conductivity when using CLIPIT as a tap connector

The high strength aluminum alloy CLIPIT deadend offers low cost, easy installation, wide range and versatility.
For reliable field performance, the CLIPIT, type UW-R, has these engineered features:

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- All parts of the CLIPIT are mutually self aligning.
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- Wide belled cable entrances of CLIPIT reduce stress points and minimize cold flow. Ears of caps confine cables, prevent splaying.

**CLIPIT**— *another engineered solution to your connector problems by*

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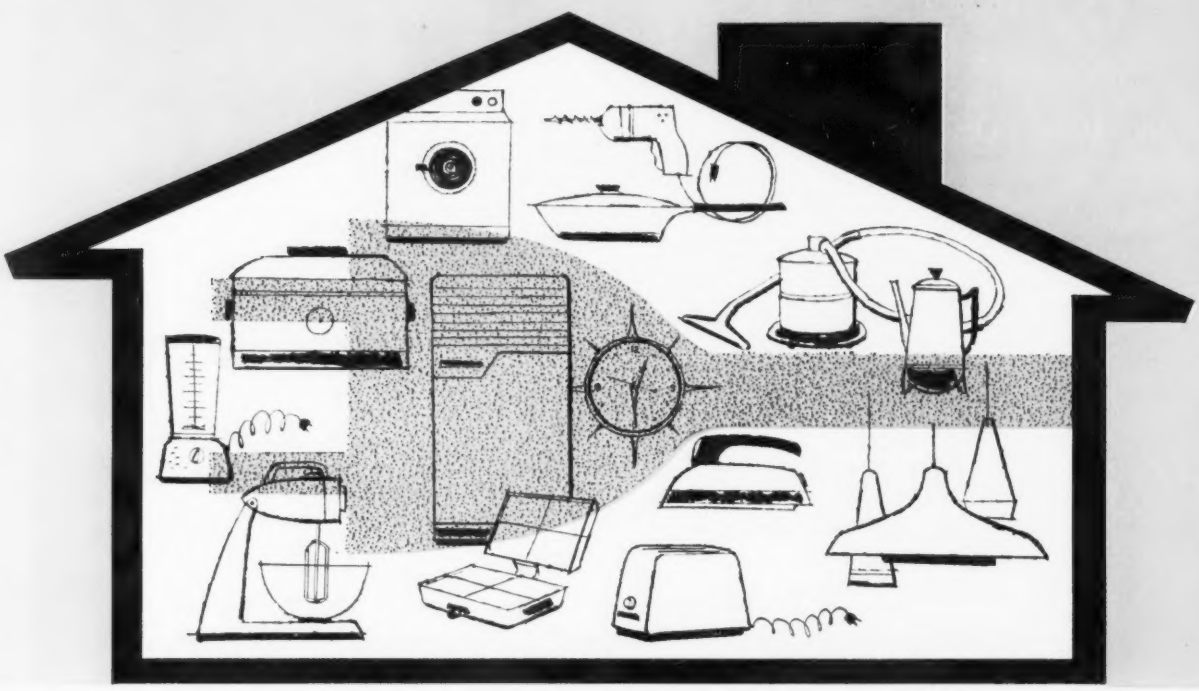
BURNDY, Norwalk, Connect., or Toronto, Canada...In Europe: Antwerp, Belgium

58-13



*It's under way now!*

# E.E.I.'S NEW INDUSTRY-WIDE $2.5 MILLION SALES PROGRAM!

For the first time, national magazines and television are spearheading a powerful drive to increase sales for the entire industry! Edison Electric Institute's dynamic National Electric Living Program kicks off this month with 3 daytime TV shows, ads in the big consumer magazines, point of sale and promotion materials for use down where the cash registers will ring.

All Electric Value Time—breaking this month—is the first of four basic selling events in the Appliance and Medallion Home program. The HOUSEPOWER program has already started, taking advantage of peak local selling periods. "Light for Living," also underway, will have its big push this fall.

All Electric Value Time is beamed to produce increased sales in both new and existing homes. Powerful national TV and magazine advertising, combined with sales promotion and merchandising, backed by strong utility support, will create sales at the local level.

### This works for all of us!

*Utilities, distributors, retailers and manufacturers—everyone in the electrical industry—may well profit from E.E.I.'s 1959 campaign.*

*This advertisement, first in a series sponsored by Kuhlman Electric Company throughout the year, is published to help acquaint the industry with this far reaching and important program.*

KUHLMAN ELECTRIC COMPANY

65th year

*the year you get more for your transformer dollars*

**KUHLMAN TRANSFORMERS**

*Manufacturers of transformers since 1894*

**KUHLMAN ELECTRIC COMPANY, Birmingham, Michigan**

**PLANTS: Bay City, Mich.; Crystal Springs, Miss.; Salinas, Calif.**